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The Personnel Journal

DEVOTED TO INDUSTRIAL PSYCHOLOGY

The Science of Work, the Human Factor in Management and the Satisfactory Adjustment of Individuals to Their Occupations

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Personnel Books

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THE PERSONNEL JOURNAL publishes original investigations in the applied sciences that contribute to knowledge and effective direction of people at work.

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Success in College and Business[1]

By Donald S. Bridgman, *American Telephone and Telegraph Company*

Does business want athletes, debaters and glee-club leaders as well as scholars? And what about the man who earns his way through college?

The Bell System, one of the largest employers of college graduates, here reports the relation of progress in that organization to student earnings, participation in activities, and scholarship rank.

This paper presents the results of studies of the success of college graduates in the Bell Telephone System in relation to a number of factors in their college life. Present salary, related to the number of years since graduation and weighted to eliminate geographical variations, is used as the criterion of success. Within a unified organization such as the Bell System it may be considered as an excellent index. There is some evidence that selective losses from the groups studied have not greatly influenced the results obtained.

Information concerning all the elements studied was available for 1310 graduates four or more years out of college who had spent at least half the time since graduation in the Bell System. Scholarship information alone had been obtained for a considerably larger number of men and the results of its analysis were published in an article "Does Business Want Scholars?" by W. S. Gifford, President of the American Telephone and Telegraph Company, in Harper's Magazine for May, 1928.

The results of the present study indicate that high scholarship, substantial campus achievement, early graduation and immediate employment in the Bell System are significantly favorable factors for success in its work. Earning of college expenses appears to be a neutral factor. In general these factors are independent of one another, although high scholarship and early graduation often occur together as well as late graduation and large earnings in college. Scholarship appears to be the most significant single index of success. The combination of favorable factors such as high scholarship and substantial campus achievement increases the likelihood of success but by no means

[1] Paper delivered before the Joint Meeting of Organizations Interested in Personnel and Vocational Guidance under the auspices of the Personnel Research Federation, Atlantic City, February 22, 1930.

assures it in all cases. It is clear that each man's interest in his work, the satisfaction of his basic motives through it and his ability to adjust himself to his environment are also most important elements in his success. Proper self-analysis and guidance in the choice of a vocation are essential to it.

Part I. Introduction

THE prediction of success or failure in business for men entering it on graduation from college is an extremely hazardous undertaking. The inter-actions of all the factors influencing them make it a problem of the most complex sort. One major difficulty arises from the very different environments faced by men in college and after graduation. If, however, the colleges are not failing seriously in at least one of their major purposes, men who are successful in them should be more likely to succeed later.

But college success is not measured by a single yardstick. Some men are high-rank scholars, others are editors of college magazines, managers of teams, great athletes. Still others satisfactorily complete the requirements for the degree while overcoming the most severe financial handicaps. Are any of these accomplishments more indicative than others of business success or do none of them give a clue to it?

To answer such questions as these was one purpose of the Bell System in establishing five years ago a centralized record of all college graduates in its companies. Such a record would be extremely useful for administrative purposes. It would permit the study of salary progress of graduates in the several companies and departments. From it, studies of their losses could be made. Its value would be unquestionable if it also assisted in improving the means by which the right men for the telephone business could be selected.

In employing college graduates some stress had been placed on their scholarship, on their participation in campus activities and on their earnings in colleges. There was, however, no definite data indicating that these were indices of success in the telephone business. To make quantitative studies of the relations between these factors and such success seemed distinctly important. Beyond this, it was hoped that such studies would be of interest and possible value to education itself.

The Bell System Companies together are probably the largest single employers of college graduates in the country. It, therefore, had a rather unique opportunity to study the progress of graduates in its employ in relation to their achievements of various kinds in college. A centralized record was therefore set up in 1925 in the personnel department of the American Telephone and Telegraph Company under the direction of Mr. E. K. Hall. Soon afterward it seemed worth while to attempt an immediate study of the relation between college scholarship and success in the Bell System.

Those colleges from which a number

of graduates had come to the System were, therefore, asked to furnish their scholarship records. From them, such a study was carried out and its results were published in the article "Does Business Want Scholars?" by W. S. Gifford, President of the American Telephone and Telegraph Company in Harper's Magazine for May 1928. This article did arouse a considerable amount of interest among educational people. Spontaneous requests were received for about 25,000 reprints of it and these were distributed.

It is likely, however, that it enhanced the Bell System's popularity with college authorities somewhat more than with college students. In fact, there was one case where a boy had been in some minor scholastic difficulty. When the telephone representatives visited the campus one of them gave this boy a copy of Mr. Gifford's article. He said, "Thank you, but do I have to read this. You see last weekend I was at home and father gave me one of these and then Tuesday I was talking with the dean and he gave me one also."

The interest aroused by this article was so great that it seemed worth while to undertake other studies immediately based on records of campus activities, student earnings in college and other factors which might be readily available. Information concerning these factors on a substantial number of men has therefore been obtained and the present paper reports this study in full.

Part II. General Problems and Study of Two Individual Factors

THE METHODS EMPLOYED

The first general problem to be considered in developing such a study is that of method which naturally breaks down into a number of minor problems. The first of these involves the criterion of success to be used. It was decided to use salary as compared with years since graduation as this criterion. It is recognized that this is not a perfect measure of success, but in an organization like the Bell System with consistent salary standards it is likely to parallel success very closely.

Although Bell System salary standards throughout the country are consistent, they are not uniform. It was therefore necessary to compensate for different standards due to economic conditions in different parts of the country. This was done by finding the medians for all the men covered by geographic areas and weighting individual salaries to a common base in accordance with the differences thus found. It was also felt that salary should be measured against years since graduation rather than years of service in the Bell System. All cases of men who had spent less than half of their working life in the Bell System were excluded entirely, however, and of those included about 60 per cent entered its work during the year in which they completed college.

A second problem arises from differing college standards, different sizes of institutions, and similar variations.

These difficulties were avoided to some extent in the study of scholarship by relating men to their own groups. The colleges were not asked whether a man had an average record of 90 or 70 but whether he had been in the first tenth of his class (as such a group would distinguish the exceptional men) and if not, whether he had been in the first third, middle third or lowest third. In other words, was he distinctly above average, average or below average? In a sense this ignores the differing standards of institutions except in recognizing that due to them a larger number of ranks would probably be artificial.

For campus activities a definitely relative scale was impracticable. On the other hand, the competitive nature of campus activities makes any record of them somewhat relative. In the study, therefore, achievement in campus activities was determined on the basis of actual offices, team membership, etc., which each man held. Consistency of judgment in this classification was insured by making it from the year books of the institutions almost entirely by a single person using objective standards previously set up.

In the case of earnings of college expenses an absolute proportion of expenses earned was determined by a questionnaire sent to the men on whom we already had scholarship and campus activity information. From this questionnaire a very high percentage of return was received. The replies to it undoubtedly present a thoroughly valid picture of the degree to which the men covered earned their way through college as a result of work carried on during the four years of their college course during both term time and their vacation periods.

The final and most difficult problem of a method was that of expressing any relationships which might be found between success and college achievement. To present such a study without a single sigma or, worse, even a correlation co-efficient is extremely hazardous. Good statisticians, however, agree that it is not illogical to avoid this usual method of expressing relationships because of the small number of ranks available without unwarranted artificialities and because with salary data that method is likely to give rather unreliable results due to the large variations from the average salary in a few cases. For these reasons a much less technical method of analysis has been used.

First of all medians were drawn both for each of the entire groups studied and for the groups selected by scholarship rank, campus achievement, etc. This method was only useful where the selected groups were fairly large and medians could rather accurately be determined. In the case of smaller selected groups, their salary distribution was compared with the salary distribution of the entire group from which they were taken.

GENERAL VALIDITY OF RESULTS

Before attempting to show the actual results obtained, some discussion of their general validity is probably worth while. Of course, these results are valid for the Bell System only. They must be interpreted in the light of the qualities which are likely to make for success in it. Quite different results might very well be obtained for a different type of business. In the

Bell System, as in other businesses, success does often require leadership of large groups of men and women or the ability to make effective public contacts. Greater emphasis, however, is placed in it on the ability to develop careful methods, to analyze thoroughly the results obtained than on high pressure salesmanship or the intuitive grasp of immediate situations.

The validity of the results depends also on the size of the groups studied. The scholarship study was made first with about 1000 cases, then for about 1500 and finally for about 3800. Almost identical results were obtained with each of these groups. All of the main groups, therefore, seem large enough to give reliable results. About some of the highly selected groups there is considerably more question.

The validity of the results may also be criticized because they are drawn from the study of a group which has been specially selected for a single industry and has remained in that industry. The influence of selection, however, may cause relationships which are less striking than those for a random group. As high scholarship and substantial campus achievement have been used as criteria of selection, when either or both are absent other compensating qualifications have been demanded.

The selective effect of losses cannot, however, be measured at all accurately. This is partly because most of these losses occur during the first year or two before there is available objective evidence in terms of salary concerning the probable success or failure of the men in question. It is partly due also to the fact that there is no record of men who left more than five years ago. The distributions of the older and younger men at least by scholarship are quite comparable, however, and, among the more recent classes, the distributions by scholarship and other campus achievements of the men who have left and of those who remain are about equal. The causes of separation thus seem not at all closely related to these college factors. Such phenomena, therefore, as the retention of high scholarship men doing well and the loss of those doing poorly or the loss of low scholarship men doing well and the retention of these doing poorly have probably affected the results very little.

SUMMARY OF STUDY OF SCHOLARSHIP

With this general discussion as a basis, it now seems feasible to go directly to the charts which illustrate the results obtained from these studies. The first figure "Median Salaries by College Scholarship Rank" of 3806 graduates in the Bell System is taken directly from Mr. Gifford's article in Harpers. In this chart the 100 per cent horizontal line represents the median of the entire group studied in terms of the years since graduation. The top line represents the median of 498 men who were in the first tenth of their classes, the next one that of 1554 in the first third of their classes, etc. It is interesting to note that this group is somewhat better than a cross section of those classes. About 14 per cent of the men came from the first tenth of their classes, about 40 per cent from the first and middle thirds and only about 20 per cent from the last third.

Fifteen years after graduation the

median of the first tenth men is 20 per cent above that for the whole group, 25 years after graduation it is 40 per cent and 30 years after graduation it is nearly 60 per cent. The median of the first third rises steadily but rather slowly and only approaches 20 per cent above the entire group median at 25 years after graduation, and is only slightly above it at 30 years after. The median of the middle third is somewhat below the median of the whole group and that of the last third falls rather steadily until at 30 years after graduation it is only 80 per cent of that of the whole group.

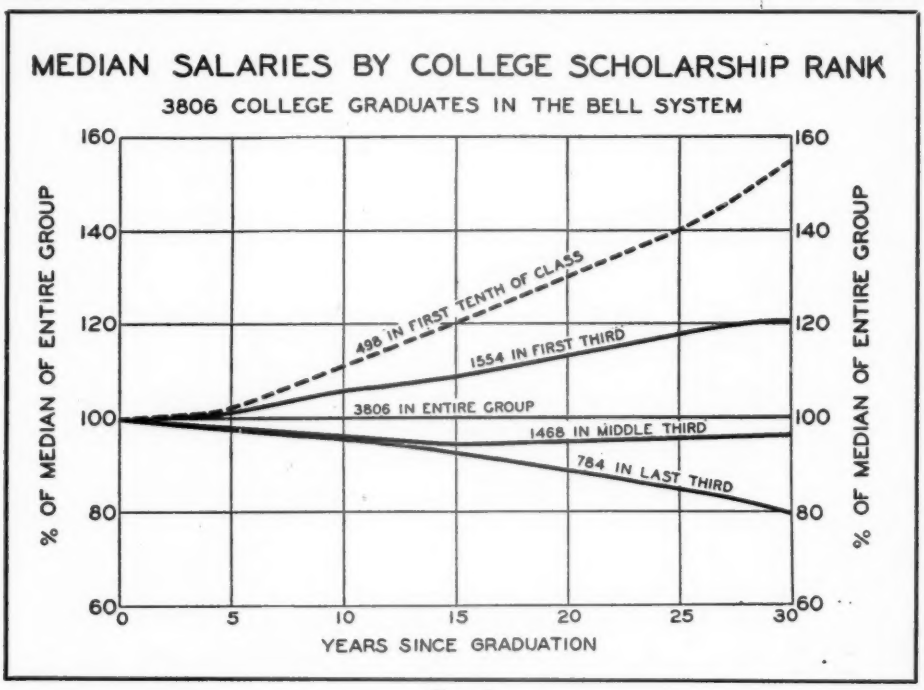

FIG. 1

THE INFLUENCE OF CAMPUS ACHIEVEMENT

Figure 2 shows the median salaries by campus achievement groups. In this case the men studied were classified into three groups, those with substantial campus achievement, those with some achievement and those with no achievement. Some achievement in this classification indicates a member of the editorial board of a magazine, the manager of a minor team or magazine, a minor class officer or the member of a social fraternity, the member of a minor athletic team or of a major varsity squad, or finally a member of a dramatic or musical club.

Substantial achievement indicates the editor-in-chief of a magazine, the winner of an important oratorical contest or member of an important debating team, the manager of a major team or important student newspaper, a major class officer or member of an honorary senior society, or the leader

of a dramatic or musical club. It also indicates some achievement in two or more fields, not including fraternity membership. That is, a man who is on the board of a paper and on a minor team would be regarded as having won substantial campus achievement but a man who was on the board of a magazine and was merely a fraternity member in addition would not be so regarded. On the basis of this classification we find that 21 per cent of the 2108 men covered by this study were classified as winners of substantial campus achievement, 38 per cent as winners of some campus achievement and 41 per cent as those with no campus achievement.

The medians in this chart have been carried only to 25 years after graduation as there were not enough cases after that point to warrant drawing them further. The median for men with the substantial achievement reaches 20 per cent above that for the whole group at the 25 year point. This is about what the median for the first third men in scholarship did. It must be remembered in comparing them, however, that this group comprises only 21 per cent of the entire group studied whereas the first third men in scholarship made up about 40 per cent of that entire group studied. Furthermore, the median for the first tenth men in scholarship comprising 14 per cent of the men studied, at 25 years after graduation is 40 per cent

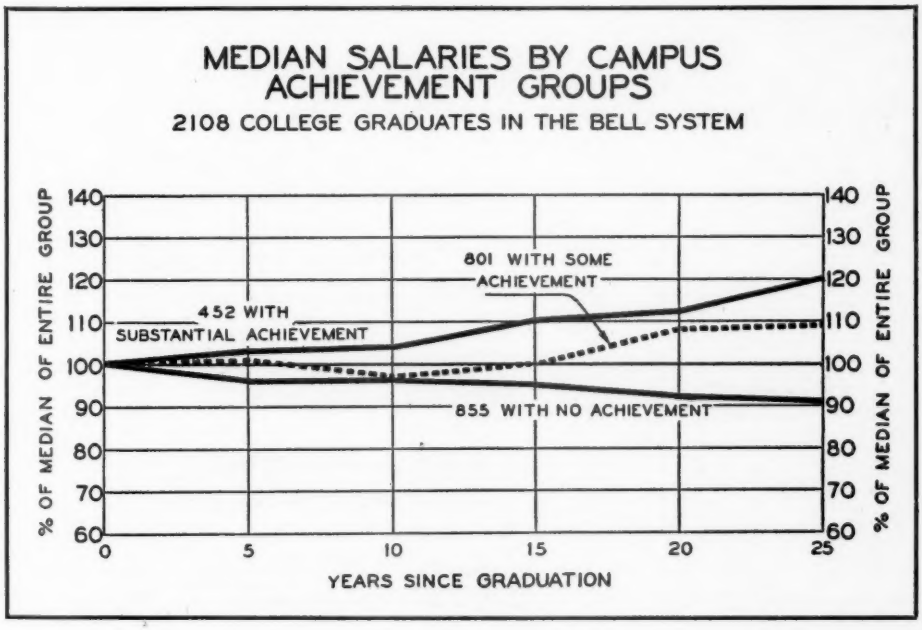

FIG. 2

above that for the whole group. On the basis of this evidence alone it seems that high scholarship is a rather more significant factor than substantial campus achievement.

Figure 2 locks together achievement in a number of different fields. It is, of course, recognized that these fields are exceedingly diverse and that achievement in one of them may be distinctly more significant than achievement in some other one. Figure 3, therefore, compares the significance of the various types of achievement by determining what proportion of the men with each type of achievement stood above and below the median salary of the entire group studied including those with no campus achievement. The A and B bars on this chart stand respectively for those with substantial and those with some achievement in the various fields. Examination of it indicates that for the men with substantial achievement the order of significance seems to be editorial and forensic achievement, managerial achievement, social achieve-

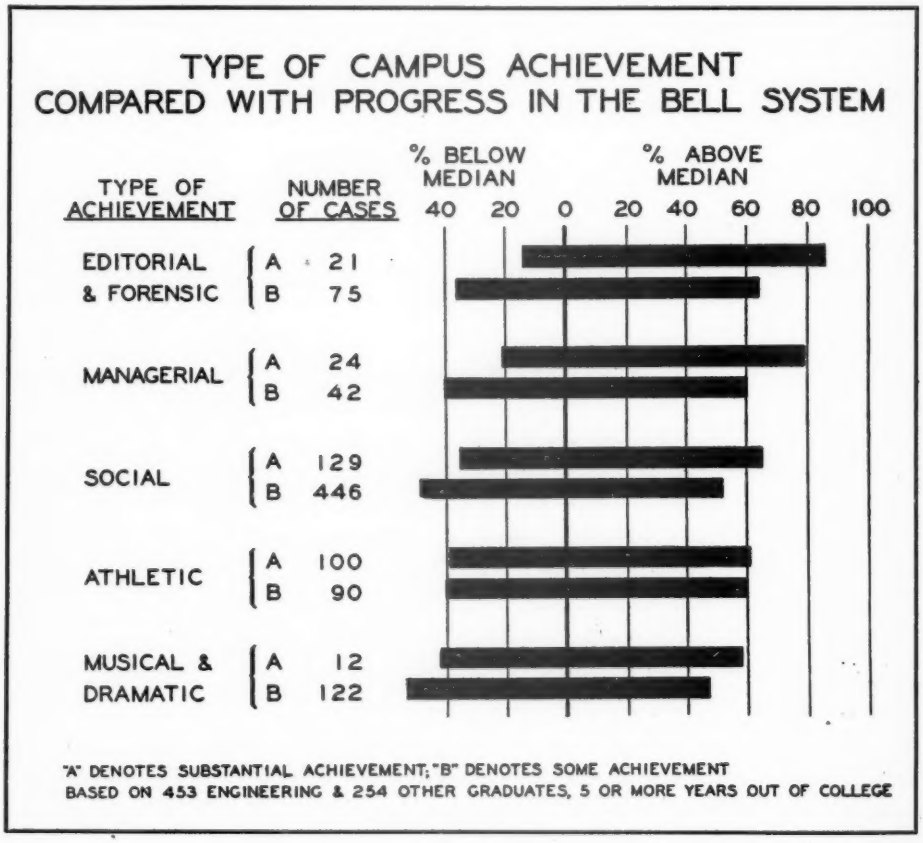

FIG. 3

ment, athletic achievement and finally musical and dramatic achievement.

Some of these groups are distinctly small but the general rank seems to be rather well borne out by the fact that the B bars also range in about the same order. The exceptions to this are in the case of social and athletic achievement but that seems to be due to the nature of those particular activities. The B bar under social achievement is largely make up of those who are merely fraternity members. The two bars for athletic achievement indicate that while it is distinctly a favorable factor, it makes relatively little difference whether a man is a member of a major team or merely a minor team or varsity squad. The only type of activity which seems to be at all unfavorable is musical and dramatic achievement without the achievement of definite leadership in it, but even here the degree of negative correlation is distinctly small.

In view of the results obtained in the study of scholarship it is distinctly interesting that the most significant type of achievement by this analysis seems to be a rather intellectual type, namely literary and forensic achievement. With outstanding achievement in this field good scholarship is also usually present; with some achievement in it, somewhat better than average scholarship. The managers, on the other hand, particularly those of major activities, are rather below average in scholarship. On the whole, however, the type of campus achievement does not seem to be very closely related to scholarship.

THE INFLUENCE OF CURRICULA

One interesting point should be mentioned here. The type of curriculum seems to have no influence at all on the significance of scholarship. Almost identical results were found for men who had graduated in engineering and those who had graduated in other courses, mainly arts and science. In the case of campus achievement, however, this was found to be true. Substantial achievement was rather less significant, although a favorable factor, for men of engineering training, than it was for men of training in arts and science. Some campus achievement, on the other hand, was rather more significant for the men of engineering training than it was for the men in arts and science. It may well be that the engineering student who spends a great deal of time in extra curricular activities may thereby neglect his college work to such an extent that it affects his future success or, on the other hand, it may be that men who are not particularly interested in their engineering work compensate for that by undue activity in other fields.

Part III. The General Study of Several Factors

INTRODUCTION

The material presented so far deals with single factors, and it has been based on somewhat different groups. It now seems useful to take a single group for which are known the scholarship, extra curricular achievement, degree of college earnings and other facts about the men and compare the effects of single factors and of combina-

tions of factors in this group. For such a group it was possible to obtain data on 1310 cases, of whom all the men were four or more years out of college. At this point there seems to be sufficient spread in the salaries received to warrant beginning the study there. Below it the spread is rather narrow and salary differences may be based on somewhat temporary factors.

In the study of this group to the three primary elements of college life, namely study, campus activities and, where necessary, the earnings of one's expenses, two others which were readily available were added, the age at graduation and time of employment in the Bell System relative to data of graduation. The latter, of course, is not strictly a college factor but it does bring out one point which seems worth making.

INTER-RELATIONS OF FACTORS

Of course, to estimate the significance of these several factors it must be known whether or not they are independent of one another, whether the same men are both good scholars and outstanding men on the campus, or are distinctly not the same men and whether men earning a large part of their way through college are therefore unable to take part in campus activities.

Figure 4 illustrates a method of analyzing these relationships. The first set of bars studies the distribution by extra curricular achievement of those men who have earned a large part of their way through college and those who have earned a small part or none of it. It seems to indicate a very slight inter-relationship between these two factors in that a slightly smaller proportion than normal of the men who earned over two-thirds of their way through college were able to win substantial achievement in campus activities. On the whole, however, these two factors seem surprisingly independent. This, of course, may be due to the fact that in some cases men earn their way through college by campus activities. For example, the editor or business manager of a paper may have made money in that way. In other cases it may even have been true that athletes obtained paid sinecures.

In studying all of the other pairs of factors not illustrated on the chart the inter-relationships were found to be less than that for earnings and campus achievement. They may be regarded, therefore, as practically independent of one another.

The two remaining sets of bars on this chart, however, do show a fairly substantial degree of inter-relationship. Thus, of the men who earned more than two-thirds of their way through college, a relatively small proportion of the group were 20 and 21 years old on graduation and a relatively larger proportion of those men were 24 and over. In fact 31 per cent of the men who earned over two-thirds of their way through college were 24 or over and but 15 per cent of those who earned none of it.

In the same way a considerable degree of inter-relation is found between good scholarship and early graduation. This is best brought out by the fact that only 14 per cent of the men who graduated in the first tenth of their class were 24 and over but 28 per cent of the men who graduated

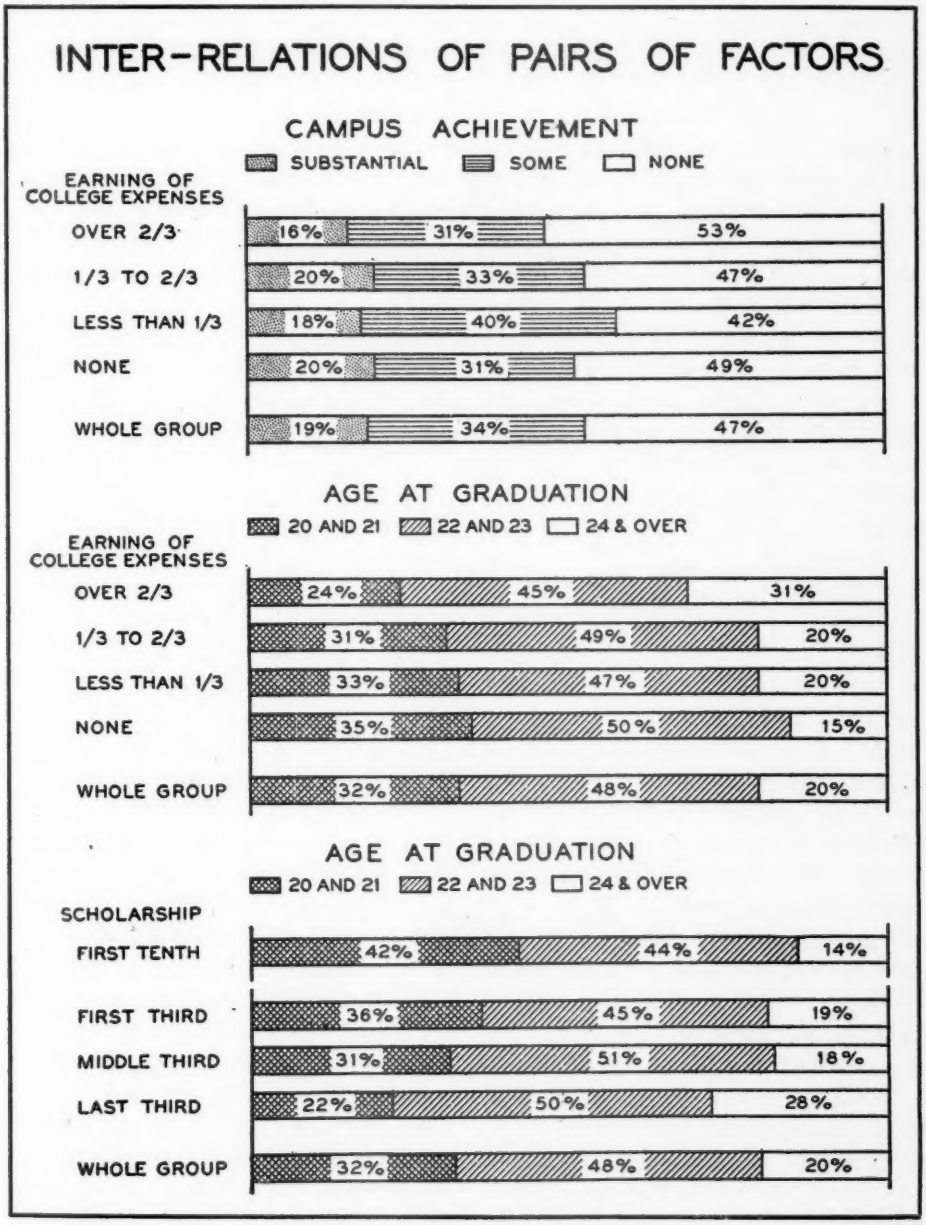
INTER-RELATIONS OF PAIRS OF FACTORS
CAMPUS ACHIEVEMENT
SUBSTANTIAL
SOME
NONE
EARNING OF COLLEGE EXPENSES
OVER 2/3
16%
31%
53%
1/3 TO 2/3
20%
33%
47%
LESS THAN 1/3
18%
40%
42%
NONE
20%
31%
49%
WHOLE GROUP
19%
34%
47%
AGE AT GRADUATION
20 AND 21
22 AND 23
24 & OVER
EARNING OF COLLEGE EXPENSES
OVER 2/3
24%
45%
31%
1/3 TO 2/3
31%
49%
20%
LESS THAN 1/3
33%
47%
20%
NONE
35%
50%
15%
WHOLE GROUP
32%
48%
20%
AGE AT GRADUATION
20 AND 21
22 AND 23
24 & OVER
SCHOLARSHIP
FIRST TENTH
42%
44%
14%
FIRST THIRD
36%
45%
19%
MIDDLE THIRD
31%
51%
18%
LAST THIRD
22%
50%
28%
WHOLE GROUP
32%
48%
20%

FIG. 4

in the last third of their class were 24 or over.

RELATIVE INFLUENCE OF SEVERAL FACTORS

Figure 5 demonstrates the analysis of this particular group in terms of the five factors studied. It shows the other method which has been used in this general study. The entire group of 1310 men was placed on a scatter diagram and lines dividing the group into three equal parts on the basis of salary were drawn. Scatter diagrams of each of the selected groups were then made and it was determined what proportion of each of them lay in the first salary third of the whole group, what proportion in the second third, and what proportion in the last third.

Thus, it is found that 53 per cent of the 185 men of this group who were in the first tenth in scholarship now are in the first third in salary, and only 18 per cent are in the last third in salary. Forty-five per cent of the men in the first third in scholarship were in the first third in salary and 27 per cent in the last third and finally for the last third in scholarship 22 per cent are in the first salary third and 45 per cent in the last third. It is important to discover just what chance there is that the distributions here found are due to errors of sampling. The chance of this, however, seems very small indeed. If scholarship were not a significant factor it would be most likely to find in any random sample about 33 per cent of the men in each salary third. If the 552 men who stood in the first third in their classes in scholarship constituted such a sample, there would be only one chance in about 100 million, that in the first salary third there would be found as much divergence from the expected 33 per cent as the 45 per cent which actually occurs represents. In the same way, in a sample of 247 men made up of those in the last scholarship third, there is only one chance in nine thousand that the divergence represented by the 22 per cent in the first salary third would occur.

Comparing this group of bars for the men distributed according to scholarship with the next set where they are distributed by campus achievement, the former conclusion that scholarship is the more significant index seems to be rather well borne out, particularly since only 19 per cent of the group won substantial extra curricular achievement, but about 14 per cent of it were in the first tenth in scholarship and about 40 per cent were in the first third.

The earning of college expenses seems to be of very little significance. At first this seems distinctly surprising but on further reflection there appears to be cause for it. In the first place it is recognized that man earn their way through college not because they are able to but because they have to. Furthermore, although the men with higher earnings were not notably below their fellows in scholarship or in their participation in campus activities, it must be true that such men have sacrificed something in the opportunity for reading, for informal social contacts with their fellows and perhaps most important, the opportunity for reflection and for gaining a broad perspective on the work they are carrying on in college.

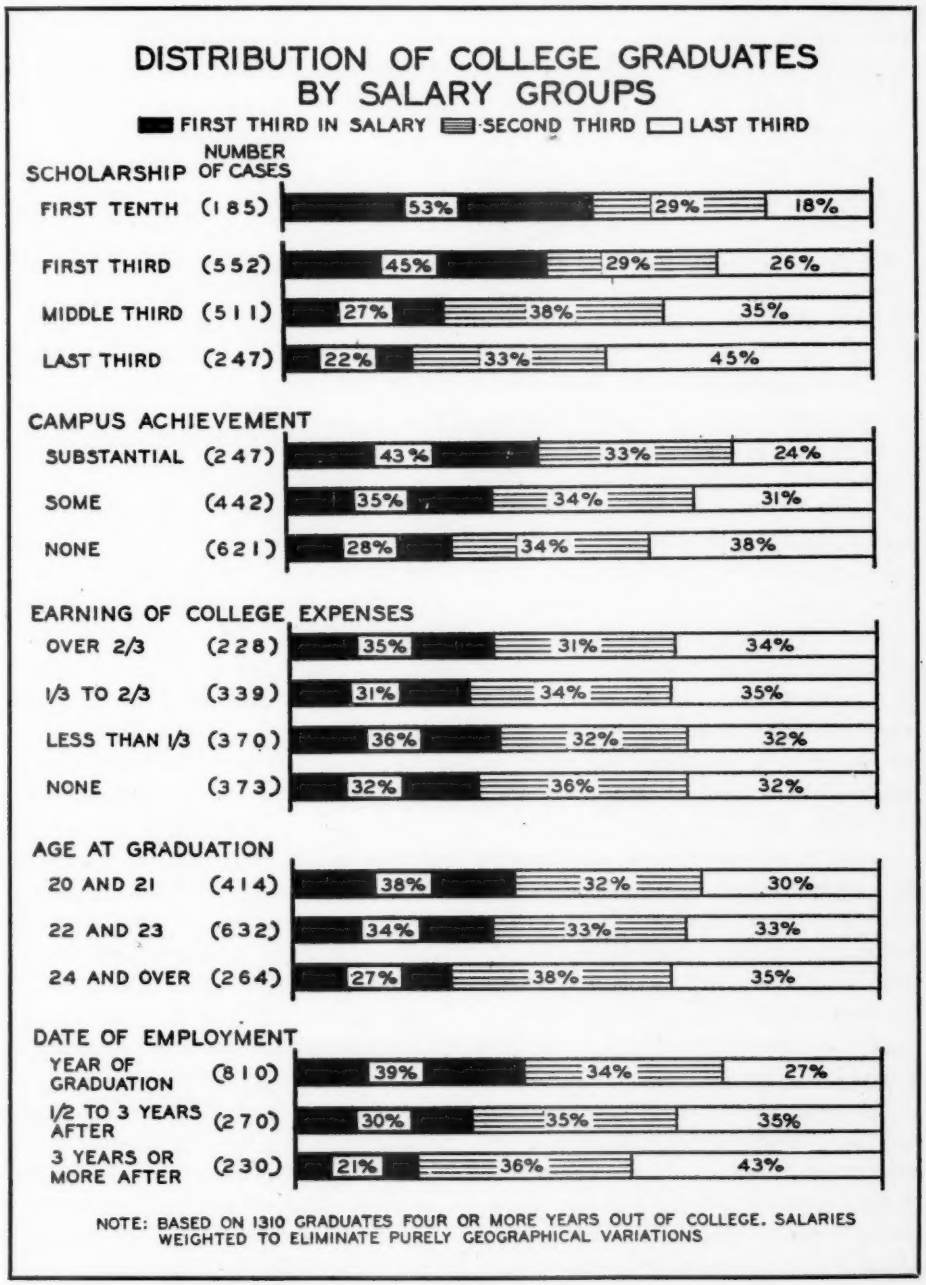
DISTRIBUTION OF COLLEGE GRADUATES BY SALARY GROUPS
FIRST THIRD IN SALARY
SECOND THIRD
LAST THIRD
SCHOLARSHIP
NUMBER OF CASES
FIRST TENTH (185) 53% 29% 18%
FIRST THIRD (552) 45% 29% 26%
MIDDLE THIRD (511) 27% 38% 35%
LAST THIRD (247) 22% 33% 45%
CAMPUS ACHIEVEMENT
SUBSTANTIAL (247) 43% 33% 24%
SOME (442) 35% 34% 31%
NONE (621) 28% 34% 38%
EARNING OF COLLEGE EXPENSES
OVER 2/3 (228) 35% 31% 34%
1/3 TO 2/3 (339) 31% 34% 35%
LESS THAN 1/3 (370) 36% 32% 32%
NONE (373) 32% 36% 32%
AGE AT GRADUATION
20 AND 21 (414) 38% 32% 30%
22 AND 23 (632) 34% 33% 33%
24 AND OVER (264) 27% 38% 35%
DATE OF EMPLOYMENT
YEAR OF GRADUATION (810) 39% 34% 27%
1/2 TO 3 YEARS AFTER (270) 30% 35% 35%
3 YEARS OR MORE AFTER (230) 21% 36% 43%
NOTE: BASED ON 1310 GRADUATES FOUR OR MORE YEARS OUT OF COLLEGE. SALARIES WEIGHTED TO ELIMINATE PURELY GEOGRAPHICAL VARIATIONS

FIG. 5

On the other hand, the men who have earned their way have shown a degree of determination and capacity for hard work that it has not been necessary for their fellows to demonstrate. There is no question that these men in general are better off than if they had not gone to college.

Early age at graduation seems to be a small but significantly favorable factor. In fact, in a random sample of 414 men such as those graduating at 20 and 21 make up, there is only one chance out of 21 that as much divergence from the expected 33 per cent in the first salary third as the 38 per cent actually occurring represents and only one chance in 38 that among 264 men, namely those graduating at 24 and over, as much divergence would occur as the 27 per cent in the first salary third represents. The chance, therefore, that both divergences would occur together is about one in eight hundred.

It must be remembered that in this analysis the younger men are also somewhat the better men in scholarship but in combining the two factors more divergence from a normal distribution is obtained than with either factor separately. There seems, therefore, to be some value in early graduation regardless of scholarship but it is distinctly small.

The final set of bars in this chart brings out the value of entering into the Bell System very shortly after graduation. In fact, the first bar comprising about 60 per cent of the whole group is made up of those whose Bell System job was probably their first permanent job. On the other hand, the last bar includes men who spent three or more years in other work before entering it. It shows a distribution that is only about as favorable as that for the men who graduated in the last third of their class in scholarship. There are, of course, individual cases where outside experience is of definite value in our work. On the whole, however, it seems to be true that a man who finds his field of work first and stays by it will do better in the long run. It should be emphasized, moreover, that this factor is distinctly independent of all the others.

THE INFLUENCE OF COMBINATIONS OF FACTORS

Figure 6 shows certain combinations of these factors. For example, the first set of bars covers only the men with substantial campus achievement and distributes them in terms of scholarship. From them, it is seen that the men who were both outstanding in campus activities and who were good students won somewhat greater success than those who were merely good students or merely outstanding in campus activities. The combination of the two factors, however, does not give strikingly more significant results.

There is here, too, one definite variation from the favorable influence of scholarship. Of the men who won substantial campus achievement those who graduated in the last third of their classes are doing about as well as those who graduated in the first third. This is probably due in part to individual variations and might not be found with larger samples. It is true also that there were in this last third group a number of men with rather unusual campus achievement and that although that group includes a number

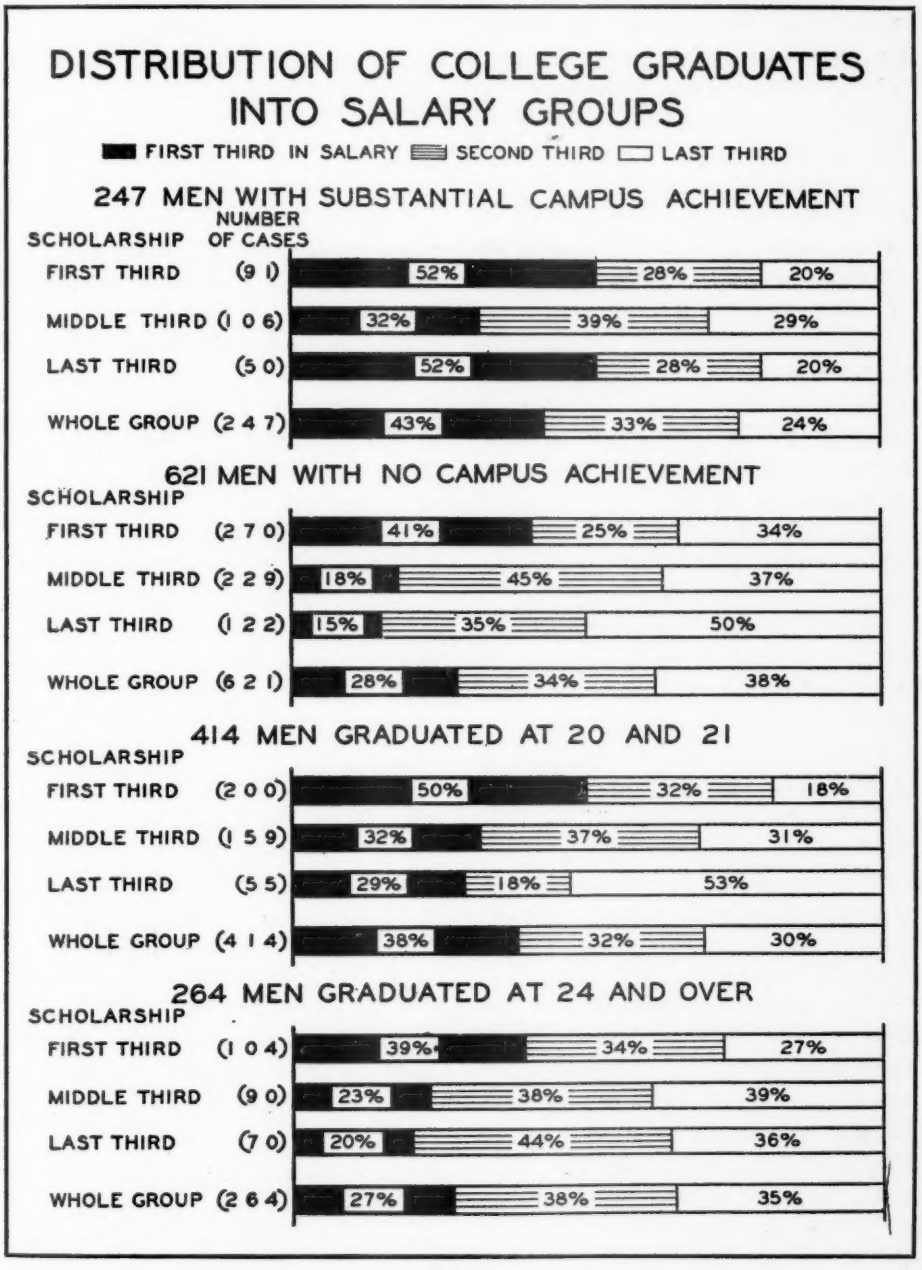
DISTRIBUTION OF COLLEGE GRADUATES INTO SALARY GROUPS
FIRST THIRD IN SALARY
SECOND THIRD
LAST THIRD
247 MEN WITH SUBSTANTIAL CAMPUS ACHIEVEMENT
SCHOLARSHIP
NUMBER OF CASES
FIRST THIRD (91) 52% 28% 20%
MIDDLE THIRD (106) 32% 39% 29%
LAST THIRD (50) 52% 28% 20%
WHOLE GROUP (247) 43% 33% 24%
621 MEN WITH NO CAMPUS ACHIEVEMENT
SCHOLARSHIP
FIRST THIRD (270) 41% 25% 34%
MIDDLE THIRD (229) 18% 45% 37%
LAST THIRD (122) 15% 35% 50%
WHOLE GROUP (621) 28% 34% 38%
414 MEN GRADUATED AT 20 AND 21
SCHOLARSHIP
FIRST THIRD (200) 50% 32% 18%
MIDDLE THIRD (159) 32% 37% 31%
LAST THIRD (55) 29% 18% 53%
WHOLE GROUP (414) 38% 32% 30%
264 MEN GRADUATED AT 24 AND OVER
SCHOLARSHIP
FIRST THIRD (104) 39% 34% 27%
MIDDLE THIRD (90) 23% 38% 39%
LAST THIRD (70) 20% 44% 36%
WHOLE GROUP (264) 27% 38% 35%

FIG. 6

of men whose salaries were sufficiently high to place them in the first third of the group studied, it does not contain as high a proportion of men of the very highest salaries and of those who are making the most permanent contributions to the policy and science of the System as does the group of first third men. Among men with no campus achievement, scholarship seems to be an exceedingly important factor.

The last two sets of bars combine scholarship and age of graduation. Since this combination gives more striking results than either factor along, it brings out the fact that each of them, regardless of their interrelations, seems to be important. These bars also show other rather interesting results. Of the men who graduated at the age of 20 and 21 but who were in the last third of their class, nearly a normal proportion are now in the first third in salary but the number of those in the middle third salary is small and that of those in the last third is distinctly large. Evidently the men who have the ability to graduate at 20 and 21 but who do a rather poor job scholastically, if they do not succeed reasonably well, are very likely not to succeed at all. This group may contain those with good ability but who are distinctly unstable. On the other hand, of the men who graduated at 24 and over in the last third of their class in scholarship, a very considerable proportion is now in the middle third of their group in salary.

The first set of bars in figure 7 distributes men in the first third of their class in scholarship by earning of college expenses. It indicates that where scholarship is kept constant the degree of earning does seem to have some significance but not a striking one.

The next set of bars takes the 91 men who were both good students and won substantial campus achievement and considers them in terms of college earnings. The first bar of this set covers the most highly selected group in the whole study, those who were good students, were active on the campus and who earned over two-thirds of their way through college. It is not surprising that 11 of these men are now in the first third of their group in salary, It is somewhat surprising that 3 of them are in the middle third and that 2 of them are in the last third. Of course, the sample is too small for final appraisal of these results.

In these bars the degree of earning among highly selected men seems to be relatively unimportant and in the final set of bars it seems to have no importance at all. In fact the smallest proportion of successful men of any group is found in that group of men who earned over two-thirds of their way through college but who were in the last third in scholarship and who won no extra curricular achievement. Here again, the sample is rather small but it does appear that these men may well have sacrificed too much to go to college and that a high degree of earning is not compensation for failure to realize on the other advantages of college life.

CONCLUSION

In conclusion there are two general observations which should be made. In the first place, it is recognized that there is no evidence of the effect of native ability in attaining success in

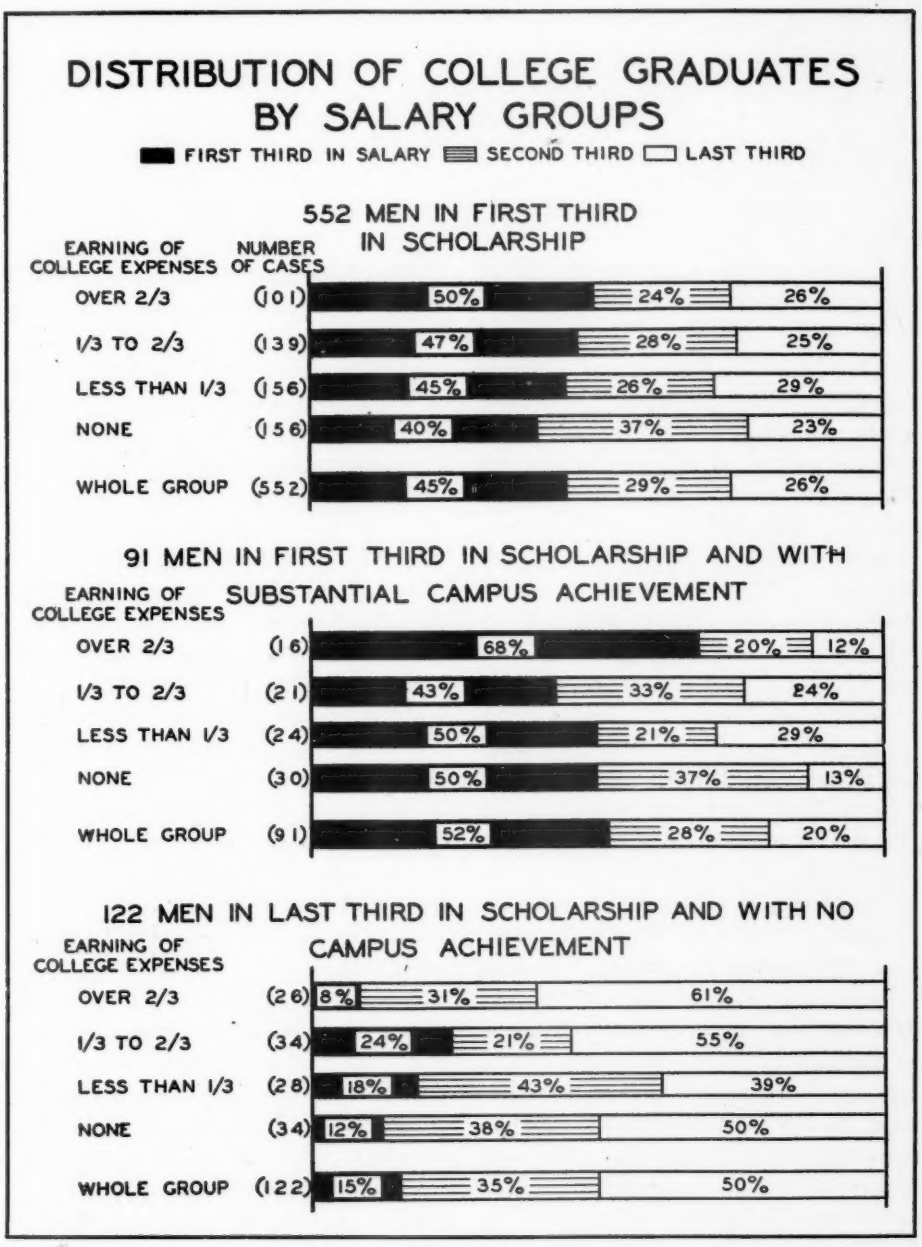
DISTRIBUTION OF COLLEGE GRADUATES BY SALARY GROUPS
FIRST THIRD IN SALARY
SECOND THIRD
LAST THIRD
552 MEN IN FIRST THIRD IN SCHOLARSHIP
EARNING OF COLLEGE EXPENSES
NUMBER OF CASES
OVER 2/3 (101) 50% 24% 26%
1/3 TO 2/3 (139) 47% 28% 25%
LESS THAN 1/3 (156) 45% 26% 29%
NONE (156) 40% 37% 23%
WHOLE GROUP (552) 45% 29% 26%
91 MEN IN FIRST THIRD IN SCHOLARSHIP AND WITH SUBSTANTIAL CAMPUS ACHIEVEMENT
EARNING OF COLLEGE EXPENSES
OVER 2/3 (16) 68% 20% 12%
1/3 TO 2/3 (21) 43% 33% 24%
LESS THAN 1/3 (24) 50% 21% 29%
NONE (30) 50% 37% 13%
WHOLE GROUP (91) 52% 28% 20%
122 MEN IN LAST THIRD IN SCHOLARSHIP AND WITH NO CAMPUS ACHIEVEMENT
EARNING OF COLLEGE EXPENSES
OVER 2/3 (26) 8% 31% 61%
1/3 TO 2/3 (34) 24% 21% 55%
LESS THAN 1/3 (28) 18% 43% 39%
NONE (34) 12% 38% 50%
WHOLE GROUP (122) 15% 35% 50%

FIG. 7

the Bell System or in attaining college success. It has undoubtedly played a real part. It seems inevitable, however, that the effective work habits and the determination to do every undertaking well which helped some of these men to win success in college, have been equally important in their later achievement.

It is impossible, however, to answer this question effectively for this group. It is agreed that there is no test of native ability for mature men of varying ages. It may be possible, however, to throw some light on it in the future. We now plan to obtain information on the results of tests which were given to men employed by us when they entered college. In doing this we recognize that most of these tests are called scholastic aptitude tests. They are given primarily to throw light on the probability of scholastic success. Formerly such tests were called intelligence tests but that practice has usually been abandoned. It may very well be that their results will not in any sense correlate with business success. The experiment, however, is worth trying.

Finally, these charts seem to indicate that good scholarship, campus achievement, early graduation, in that order are significant indices of success in the Bell System. Earnings in college are not significant. On the other hand, it has been found that not all the members of the groups which were highly selected by combinations of these several factors do succeed. It is very evident that other elements are highly important. What all of these elements are, we have no way of knowing. They certainly include a man's ability to adjust himself to the environment of his home and of his business as distinct from his ability to adjust himself to the environment of college. Another important element seems to be interest in and individual ability to do the work which a man has selected for his life work. Still another is the degree to which the organization with which he is connected can offer rewards which are in line with his most fundamental motives.

It is certainly true that the student who has done well in college, if he is to realize on the capacity and promise thus shown, cannot afford to neglect a careful analysis of himself and a thorough consideration of the businesses where his talents are most likely to be useful. He who has done badly in college has no occasion to believe that his pace has been permanently set. If he has discovered his own motives, his own interests and ability, if he has gained perspective on the things which may have hindered him in college, he may well choose a field of work in which he will surpass the men whose college achievement is more spectacular. In this regard, the industries who are employing college men carry a very grave responsibility. In employing these men they must adopt the broad point of view and must consider not only the degree of general promise which a man has but whether or not he is likely to succeed in that industry, whether or not they have his kind of work, and can offer him the type of reward which will maintain his enthusiasm.

Last of all it is very clear that the opportunity which college personnel and placement officers have is a very

great one. It is they who can help the student to solve problems which he may encounter in college; who can develop with him a method of meeting such problems when they occur in later life. It is they who should help him to discover what the requirements and rewards of various businesses are and interpret these requirements and rewards to each student in the light of his own capacity and fundamental motives.

Manuscript received February 22, 1930

Progressive Developments in the Colleges[1]

By Chauncey S. Boucher, *University of Chicago*

This statesmanlike appraisal of the situation in the colleges, by the Dean of the College of Arts, Literature and Science of the University of Chicago, points directly toward the next necessary step in individualizing and vitalizing college education.

ONE who uses any form of the word "progress" runs the risk of being challenged with the bromidic wise-crack that "progress is a delusion." Colleges and college students are the particular butts of wise-cracks. This one is typical: "An American college is a great athletic association and social club in which provision is made, merely incidentally, for intellectual activity on the part of the physically and socially unfit." Here is another frequently heard, in the form of a conundrum: "Why is a college a great repository of learning?" Answer: "Because the freshmen bring in so much, and the seniors take out so little." Recently one of our better magazines published an article made up almost entirely of wise-cracks, entitled "Quack-Doctoring the Colleges," written, strangely enough, by a professor in a college which, with its sound progressive innovations of the last decade, has done much to give meaning and significance to the Bachelor's degree. Wise-cracks are frequently amusing and stimulating; a good one twits on facts; but most of them are dangerous, if taken too seriously by the author or his readers, because they are only partially true and usually grossly exaggerate.

With keen appreciation I quote from another recent issue of one of our better magazines a definition which satisfies as can no smart-aleck wise-crack: "Education is the process by which one's mind is given discipline and discrimination, orientation in the modern world and understanding of it, and the adult ability to derive satisfaction from knowledge and from the pursuit of knowledge for its own sake." This definition of education in terms of basic and meaningful objectives, spells progress. What have we been doing recently to live up to such a definition?

Students, faculty members, and administrative officers of our better colleges are at present more constructively critical of the shortcomings and failures of the existing program and methods

[1] Reprinted by permission from The University of Chicago Magazine, February, 1930.

The word "Colleges" is meant to include those educational units organized on the four years basis, granting the Bachelor's degree, whether existing independently or as part of a university.

of undergraduate education than at any previous time in our history. The time and efforts of many persons are being devoted to a critical study of curricula, methods of instruction, and administrative and personnel problems of considerable variety through such agencies as national and local group conferences, commissions, committees, the questionnaire, and specially-appointed visiting agents. A day seems incomplete if it has not brought a questionnaire from another institution, and visitors on mission of inquiry and investigation are with us frequently. Change in performance merely for the sake of doing something different is foolish and dangerous—"quack-doctoring," indeed; but change based upon a careful study of the shortcomings of past performance in the light of tested thought and more clearly defined objectives is inspiring because charged with possibilities for progress. Though the limits of space do not permit adequate exposition and discussion, I shall list a few of the new developments successfully inaugurated in the last few years, and venture an opinion regarding the next needed departure.

EDUCATIONAL GUIDANCE

During the early history of our colleges, indeed down to a time within the memory of living men, there was no problem of educational guidance for students, because the curriculum was fixed. There was no choice between meat offerings or dessert offerings; each student was fed the same intellectual menu as every other student who entered at the same time. Came a time when research work broadened the limits of old fields of knowledge and opened up entirely new fields. New courses could be introduced only if electives were introduced. In order that the curriculum should reflect the widened boundaries of knowledge electives were introduced, at first sparingly, and then wholesale. As is typical of us in so many phases of life, we went from one extreme to another—from the rigidly fixed curriculum to the almost completely elective curriculum. Twenty years ago, in many colleges, entering students faced a formidably large catalog with literally hundreds of course offerings, not clearly described and not properly related, with the elective system in vogue and with no faculty member and no administrative officer available to help them solve the Chinese puzzle of course elections. Throughout his four years a student with no definite professional aim, finding no one on the college staff to guide him, more often than not would drift from one subject to another, depending upon chance, caprice, or student gossip for his guidance, and would come out at the end of four years with an academic record sheet worthy of a place in an educational museum. And yet, a student with a constitution strong enough to withstand such a stuffing of utterly indigestible and unassimilable educational hash, would come out triumphantly with a diploma and a degree (though frequently without anything worthy of being called an education), provided only that he had accumulated a certain number of course credits. It is no wonder that in this period our college students developed for themselves as never before outlets for their

best thought and efforts, "Student Activities"—athletics, publications, dramatics, and a vast number of purely social activities—something interesting and more worthwhile than the meaningless and deadly academic mummery.

After seeing from experience the folly of both extremes—the rigidly fixed curriculum and the wide open elective system—the better colleges have endeavored to strike a happy medium by specifying degree requirements in general but meaningful terms, and by providing an educational guidance service. Regarding the former, the best practice now provides for a number of group requirements—English, foreign language, mathematics, natural and physical science, and social science—designed to furnish a proper balance in an introduction to general education to be completed by the end of the second year, and a sequence or concentration requirement for the last two years, so that a student may be sure to get deep enough into at least one branch of knowledge to master its technique and method of thought—so that he may think and express himself like an educated person in at least one field of thought. The educational guidance service—by a number of faculty members, whether called deans, advisers, or counselors—provides, when functioning properly, a sufficient number of faculty members, carefully selected because of appropriate qualifications, to give a reasonable amount of time to each student individually, to plan *with* each student, as well as *for* him, an educational program which seems to offer for him most possibilities for pleasure and profit in its pursuit. These educational guidance agents, with students assigned to them on the basis of scholastic interests, play the rôles of guides, counselors, and friends, and are doing our most effective personnel work, of great variety, incidental to and as a natural part of their educational guidance work.

Recently we have heard much blare of trumpets about a fifth wheel to the college cart—an independent personnel department, whose staff members are not faculty members and are responsible only to the president's office. A college which has set up such an agency has done so apparently on the assumption that because faculty members have so long neglected their duty regarding educational guidance and all related personnel problems, they can not or will not study and meet this personnel service obligation of the institution to its students, even if the proper leadership were furnished. If this is so, then indeed there is no hope in us. However, I know from personal observation that, in a number of institutions, where the matter has been put before the faculty in an intelligent manner, it has not been difficult to recruit a sufficient number of faculty members in a very short time to afford adequate student service by men and women who derive great personal satisfaction from the service and soon acquire new points of view which make them all the more valuable as members of the staff of instruction. The faculty members not personally in this service soon come to look to those members in the service for opinions and recommendations of great value in faculty meetings when matters of academic legislation are considered. I have at-

tended national and local conferences of personnel workers of both types—faculty members and independent, full-time personnel workers. At the end of each conference I felt that I had never before been exposed to such an incongruous mixture of bunk and sound sense; and most of the bunk came from the non-faculty member workers. It is no wonder that these independent personnel departments, in most institutions where they exist, are looked upon with suspicion and distrust by the faculty members.

Freshman Week is another recent innovation attracting attention. I have examined the printed programs for this week at several institutions. It is quite natural that, in the early stages of this experiment, there should appear many features open to question on many scores. At present, the better colleges which support a Freshman Week have centered their programs around two objectives: educational guidance and orientation into college life generally. Our experience at the University of Chicago has led us to center very largely on the former, and to continue it and to develop the orientation project throughout the first term through individual conferences and general assemblies for Freshmen.

COURSE OFFERINGS

When old fields of knowledge were broadened and new fields explored by a most praise-worthy activity in research, which began to bloom and produce fruit in the closing decades of the last century, new courses began to appear in college catalogs, slowly at first as the fixed curriculum gradually gave way, and then very rapidly when the elective system became general. Came a perfect flood of new courses of wondrous variety and description. The college catalog of many institutions in the early 1900's became a most formidable document in size and meaning. A critical examination of the courses announced in any one of two dozen departments in a single college would have shown that perhaps half of the courses in any department could not justify themselves on any ground, save one—they offered the instructors opportunities to pursue pet hobbies in a very limited part of a field—and that the course offerings of the department were not properly related and balanced.

This much-needed and too-long-delayed critical examination of departmental offerings has been brought into being in a steadily increasing number of colleges, particularly in the last ten years, by study of the problem of educational guidance and by the development of the Junior College movement.

In what may be termed the "chaotic" period, when the wide-open elective system ran riotously into utter confusion—a period which lasted in most institutions until ten or less than ten years ago, and still persists in some institutions—most departmental introductory courses were designed with the sole purpose of preparing students for advanced courses in the respective departments. It seemed that nearly every department framed its curriculum as though the intellectual sun rose and set within its boundaries, as though every worthy student must desire to specialize in that department, and as though that department had a life-long vested interest in every student who elected its introductory

course. Most departments seemed to think only in terms of specialization, and seemed to be interested not at all in students who wanted and needed an introduction to several departmental fields of thought as essential parts of a general education.

In the last decade a basic theory of college education has been put before us more and more frequently and with increasing forcefulness, that though a student who enters college with a well defined educational and perhaps vocational aim should be given the opportunity, and should be encouraged, to pursue that aim from the beginning of his freshman year, the major emphasis in the junior college years should be placed upon breadth of general education; and that, though general education should continue in senior college, the major emphasis of the last two years should be upon concentration in, and depth of penetration of, some particular field of thought. Thus the attention of each department has been called to its obligation to offer appropriate introductory work to no less than three types of students: first, students who expect to specialize in that department, or to center their senior college concentration in and around that department; second, students who know that they will not specialize in that department and yet desire its introductory work for the sake of rounding out a general education, or as an aid to work in a related field of thought; third, students who have not determined upon a field of concentration, but are looking for what may become for them a major educational interest.

Though one department may find it possible, after careful study and planning, to design and offer a single course which will serve adequately and satisfactorily the needs of all three types of students, another department may find it advisable or even necessary to offer two introductory courses—one for the first type, and another for the second and third types of students. In the last few years one department after another, in our better colleges, has studied its course offerings as not before, in a generation, and has had the courage to scrap many of its old courses and introduce a new set, fewer in number and arranged in a well ordered, progressive sequence, with elementary courses designed not only to furnish the foundation material necessarily prerequisite for the departmental advanced courses, but also to serve the needs of students who are interested in a particular department only in so far as it contributes to a general education.

One of the first and most significant products of the study recently devoted to educational objectives and the curriculum, has been a new type of course, called an orientation or survey course. Though the first of these courses was in the field of the social sciences, similar courses have been developed in the natural sciences, the humanities, and the fine arts. In the main they are Freshman courses designed to orient the student in a large field of thought which, it is now recognized, frequently runs through and across many of the artificial boundary lines which have been established by the growth of the numerous departmental divisions which universities have developed and formalized. One example, no longer

in the experimental stage but a proven success, is a course which covers the whole field of the physical and natural sciences. For a student who may want no more than an introduction to the field of science, this course seems to be more profitable than any one of the old style departmental introductory courses; and for the student who expects to specialize in one of the sciences, this course gives him an excellent background for later concentration—it shows him the true position of his specialty in a larger field of thought, together with the contributing values of each specialized department for the others in the larger field of thought. The appearance of these general survey courses has caused more than one department to restudy the content of its introductory course with a view to making it satisfactory not only for the student preparing for advanced work in that department, but also for students who desire some knowledge of one departmental field as part of the preparation for work in a related field, and for students who desire some knowledge of this or that departmental field as part of a general education. At the present time it is clearly evident that our course offerings are rapidly becoming better organized individually and collectively than ever before.

INSTRUCTION

It is indeed refreshing to find our colleges giving increased attention to class-room instruction, not merely on the score of subject matter content, but also in regard to the personnel of the instructing staff and methods. In the later decades of the last century and the early years of the present century, our faculty members developed research productivity to a remarkable degree. I would be the last person to belittle the importance of research. It is a well known fact, however, that in too many institutions research was made a fetish to the extent that good teaching was not only neglected but was actually scorned. Faculty members were appointed in too many instances for research ability only, with no inquiry made regarding teaching interest or ability and indeed, in some instances, in the face of positive knowledge that they were failures as teachers. Every university worthy of the name should be able to afford a few research appointments for some of our most remarkable researchers who have neither interest in nor talent for teaching; such men more often than not can work successfully with a few advanced graduate students, but these men and undergraduate students should not be made to suffer together. In recent years the tendency has grown for colleges and universities to insist that new staff appointees be not only creditable, if not brilliant, research producers but also satisfactory, if not actually inspiring teachers. There is no inherent incompatibility between effective teaching and research; indeed the latter should promote the former, if the faculty member has anything approaching a proper sense of value and proportions. Teaching interest and ability is actually being given more consideration in faculty appointments than at any time in the last half century.

And as for methods of instruction, it is no longer a disgrace and a cause for shame to confess an interest in the

study of, and experimentation with, new methods. The lecture method, "by which the contents of the professor's notes get into the note-book of the student without passing through the mind of either"—to quote another wisecrack—that relic of the period when printed books were scarce—is being questioned so that its abuses may be eliminated and its profitable uses stimulated. We are classifying our students for course units on the basis of appropriate levels of advancement. Illuminating experiments with the size of classes, sectioning on the basis of ability, promotion at any time in the term on the basis of demonstrated ability, special treatment for leading students, independent study periods (with classes suspended), various forms of the tutorial system, and scholastic aptitude and placement tests, are well under way with varying degrees of success and much promise for valuable effects upon future procedure.

One of the most noteworthy examples of special treatment for leading students has swept across the country in the form of honors courses. Though details of practice differ widely in various institutions, the basic feature of all honors plans provides for the better students in the last two years release from much of the formal and perfunctory class performance and gives much freedom and encouragement for self-education. Under the guidance of a tutor or departmental counselor each student pursues an individually approved program of work, depending upon the special interests and aptitudes of the student. The student is awarded the Bachelor's degree with honors provided he pursues his program successfully and passes a final comprehensive examination in the field of the honors award—an examination which is of far more value as a demonstration of ability to think straight and to use factual information intelligently (real mastery of a large field of thought), than any number of examinations upon the completion of small units of work in isolated courses. This is excellent, as far as it goes, but it affects only the top stratum of our student body and puts significant meaning into college work for but a few of our students. I confess that my main interest in honors systems is found in the suggestions and examples they offer for modification of our procedure with the entire student body. This leads me to state my opinion regarding what this should lead to.

THE NEXT DEVELOPMENT

For some time a number of us, who have been studying present performance in college education throughout the country, have been questioning the most basic feature of degree requirements as now stated and administered —the course unit and course credit system. If we are to live up to the definition of education quoted in my second paragraph, we must free our students from the toils of the credit system, stated in terms of hours or courses, a certain mystic number of which is the *sine qua non* for a degree in all institutions, and in far too many is the sole requirement.

Our secondary schools have made remarkable progress in the last few years; indeed, though the graduates of these schools are entering colleges in far greater numbers than ever before,

they are better prepared than ever before. Our high-school graduates in many instances are now better educated than were many college graduates a few decades ago. Our college undergraduates are keener, more alert, more inquisitive, and more active intellectually than were the undergraduates of two decades ago. Though some of our state institutions, for political reasons, are unable to limit numbers or to require for entrance anything more than a certificate from an accredited high school, many colleges have limited their numbers and have invoked selective admission to insure higher quality. Institutions of the latter type have the best opportunities to individualize, to humanize, and to vitalize their educational processes; they should have in mind, as ends to be attained so far as may be practicable, (a) the substitution of fields of study for the present course units, (b) the provision of opportunity for the exceptional student to make more rapid progress, (c) the abolition of the present system of counting credits for a degree and the substitution therefore of comprehensive examinations and whatever other methods of demonstrating accomplishment may be expedient, and (d) in general, greater emphasis upon the student's opportunity for responsibility for his own education.

In the light of several new departures already successfully operating in a number of our most progressive colleges (discussion of which is not permitted by the space limits of this article), and in view of the temper of thought among progressive leaders in many colleges, it seems that some institution in the near future will surely furnish the courageous leadership of example now so eagerly awaited in many quarters. Some college, already worthy of classification as progressive, has a remarkable opportunity to put all other colleges greatly in its debt, by adopting a program which will gather together the best of the recent but already successfully tested developments, and then take the final step which seems to require most courage—the substitution of the demonstration of ability, achievement and accomplishment for the book-keeping sytem of hours and course credits for the degree award. Because we are so much the slaves of custom in regard to administrative practices and machinery once adopted, this step seems a most radical departure. However, a careful study of the shortcomings of our past performance along with the remarkable results attained at Harvard with comprehensive final examinations, the tutorial system, and the independent study periods—to cite only one institution—would quite likely convince even one of conservative inclinations that the step suggested is sensible and logical at this stage of our educational experiment.

(*Manuscript received February 21, 1930*)

Skill and Specialization*

A Study in the Metal Trades

Part I. The Nature and Measurement of Skill

By Mildred Fairchild, *Bryn Mawr College*

To analyze the skill of the workman in relation to the specialization of his work has required first a clarification of terms and an improvement of research techniques. The data here presented were secured in four metal manufacturing plants. Their interpretation has a vivid significance in a time like the present, when technical advance is complicating the problems of occupational adjustment.

This paper reports the methods and findings of a study made in four metal-manufacturing plants for the purpose of discovering the relationship between skill and specialization in workmen. A conception of the meaning of skill is arrived at first of all. The study included an analysis, by the Gilbreth motion-study technique, of the jobs of 75 workmen into terms of therbligs, and an evaluation of the skill shown in these jobs through their further analysis into skill-factors, by a method original with this study. By the use of the skill-factors, the Gilbreth simo-chart is expanded into a simo-skill-chart through which the therblig-skill-averages of the workmen are computed. From the therblig-skill-averages, indexes of the skill of each workman (1) in relation to the skill of other workmen on the same machine (2) to that of all workmen studied in his plant, and (3) to that of all workmen studied in the four plants, are arrived at by formulae based on simple principles.

Part II of the paper takes up the case studies made of each workman in which ratings were given (by methods familiar to all who have made

* This study was undertaken at Bryn Mawr College during the year 1927–1928, under the direction of Professor Susan M. Kingsbury, director of the Carola Woerishoffer Graduate Department of Social Economy and Social research, and of Dr. Lillian M. Gilbreth, of Gilbreth Incorporated, consulting engineers and originators of Gilbreth motion study and job analysis. The writer developed the plan of study and of analysis, directed the field and laboratory work, developed the formulae, made the calculations and interpreted the results. In order to obtain a field of research broad enough to yield significant result, six graduate students, members of a seminary in social and industrial research conducted by Professor Kingsbury, served as field investigators. Miss Annie Shaw, one of the students, assisted in the development of methodology needed and has started a study of her own on skill and satisfaction which will continue the research. Other members of the seminary were Bertha Blair, Thelma Coe, Abba Fernald, Margaret Inabnit and Lillian Shapiro.

case studies in industry) on psychological attitudes as well as on the more definitely measurable factors of production standing, trade training and previous education, wages, hours, conditions of work, etc. The study dovetails the statistical and case-study methods.

The findings of the paper are arrived at largely through comparisons and correlations of the skill indexes with the ratings arrived at through case study. The findings indicate that where skill exists and is given play to a considerable degree, it tends to become the first and greatest source of satisfaction to the workman; and that specialization of work may certainly be associated with lesser skill in workmen. A determinable reduction of skill required occurs in accordance with the degree of specialization of work. If this is true, the skill, actual and potential, of workmen is one of industry's vast and unexploited resources. The findings indicate, too, to the author of the paper, that the skill-index for skill evaluation, based upon the simo-skill-chart and derived from the therblig-skill-average of the workman, is both practicable and trustworthy, even though crude. The study indicates a need for further study of skill, and particularly for a technique whereby the degree of skill used by a workman in a certain process may be measured.

JUST what is the relationship between the skill of a workman and the degree of specialization of his work? It has been assumed in some quarters that automatic machinery, with the consequent high degree of specialization of work, has brought into existence a human automaton to tend the machine, devoid of skill, and of pride or satisfaction in his work. By others it has been assumed that the greater the accuracy of the machine-made product, the greater the accuracy of workmanship demanded, and hence the greater the skill of the worker. It was in an attempt to arrive at some specific answer to the question of the relationship between skill and specialization in modern industrial life that the study, whose methods and findings are recorded in this paper, was undertaken. But before describing the technique used in approaching this problem, it is necessary to discuss the nature of skill and arrive at some agreement as to the use of terms.

1. THE NATURE OF SKILL

DEFINITIONS OF SKILL

If any man shows himself extraordinarily able to perform some function not easily performed without practice, whether in the field of craft, art, sport, or other branch of directed human activity, it is usual to refer to him as a person skilled in his particular field of action, and to call the ability which he displays in his performance, skill. According to the *New English Dictionary*, skill is "discrimination or discretion in relation to special circumstances"; or again it is "capacility of accomplishing something with precision and certainty." According to the *Oxford Dictionary* it is "expertness, practical ability, facility in doing something."

While the word, for the most part, is loosely used to mean a number of things, certain attempts have been made to define, more specifically than the dictionaries have done, the precise nature and meaning of skill, with its psychological and physiological connotations.

From the psychological point of view, Pear[1] has, more than any other, considered the subject. His definition and analysis are significant. "Skill," he writes, "is the integration of well-adjusted performances." It includes a group of well-formed habits. The skilled sportsman or craftsman for instance, has a whole set of well-directed responses rising spontaneously to meet certain stimuli—as, the tennis player grips his racquet, and the woodworker his hammer, with an habitual grip. But the outstanding feature of habit, Pear points out, is its specificness. Habit is "acquired specific response to a specific situation," while skill includes the ability to meet a varying situation with the proper response to obtain a desired end. Skill, therefore, "implies discrimination of the situation and graduation of the response." Its essential characteristic is "the ability to integrate responses and, in the highest skills, to substitute instantaneously if necessary one type of integrated response for another." Skill, as distinct from habit, involves "the ability to be aware of and to correct faulty adjustment. A surgeon's or automobile driver's skill implies this. While it consists partly of habits, skill permits immediate interference with any single habit or combination of them."

For the purposes of this study we have accepted Pear's conception, that *skill is the integration of well-adjusted performances, adapted under varying situations to the attainment of a desired result.* While it consists primarily of habits, it is more than merely a "congeries" of habits. The habits, at least, must be of the kind to ensure adaptation.

The same points are emphasized by Miles.[2] Writing of the acquisition of muscular skill in industry, he states: "The essential feature of skill is the ability to modify as required a series of movements that are in the main habitual."

The industrialist, in contrast to the psychologist, usually does not define skill at all. He uses the word freely, but in most industries, as Bezanson[3] has pointed out, there is little preciseness of definition as to what constitutes skill or its lack. The result is a looseness of use and meaning. The precision expert, who standardizes with the utmost care the terms he uses to describe the essential elements of machine and materials, refers with equal vagueness of meaning to skilled, semi-

[1] T. H. Pear. The Nature of Skill. *Journal of National Institute of Industrial Psychology*, October 1928, vol. 4, no. 4, pp. 193–194. See also: Skill. JOURNAL OF PERSONNEL RESEARCH, April 1927, vol. 5, no. 12, pp. 478–489; *Skill in Work and Play*. London: Methuen, 1924, pp. 37–45; and *Fitness for Work*. London: University of London Press, 1928, pp. 16–35.

[2] G. H. Miles. The Acquisition of Muscular Skill in Industry. *Journal of the National Institute of Industrial Psychology*, 1926–27, vol. 3, pp. 45–50.

[3] Anne Bezanson. Skill in Industry. *Quarterly Journal of Economics*, 1921–22, vol. 36, pp. 626–645.

skilled and unskilled workmen, and to skilled, semi-skilled and unskilled work. The consequence, as Pear[4] has noted, is a certain amount of acrimony in debate which often might have been avoided by a proper recognition of the precise nature and content of the matter discussed.

The industrialist, indeed, has done more than use the word vaguely. He has used it confusingly. In his discussions of the increasing mechanization of work, when he refers to the embodiment in the machine of powers and capabilities which previously belonged only to the skilled workman, he has called the process "the transfer of skill" from workman to machine.[5] By that use of the word he has made skill mean only the practical power of accomplishing a specific result; and in so doing he has confused the means with the end. He has made skill a characteristic of a machine as well as an attribute of the workman.

This looseness of definition is contrary to the spirit of science; such a broad interpretation of a word renders it incapable of being used and understood with precision. Just as engineers and scientists have reduced their tolerances in work to a fine scale, so psychologists and sociologists must clarify popular concepts and insist upon a precise use of their terminology if they are to obtain anything like precise results from their analyses.

THE INADEQUACY OF THE STUDY OF SKILL

The vagueness of the precise meaning of the word skill at the present time, however, is not to be wondered at if one realizes to what a comparatively small degree skill has been the subject of study and analysis.[6] The attainment of skill has, of course, long been a fundamental requirement for man's development along many lines. But to cultivate a quality and to recognize the essence of that quality are two different things.

In industry, for example, much attention has been given in recent years to methods of work. The discussion of "the one best way"[7] and the development of motion study on both sides of the Atlantic Ocean is an effort to catch and to standardize, within reasonable limits and with due regard to individual differences, the skill which goes into a superior performance. But a consideration of the vital mental or muscular qualities which constitute that skill has not been attempted by engineers and has been only touched upon by industrial psychologists who have used the motion-study techniques.

Some effort has been made to measure proficiency of work by output.[8]

[4] T. H. Pear. Skill. JOURNAL OF PERSONNEL RESEARCH, April 1927, vol. 5, no. 12, p. 482.

[5] See L. P. Alford. *Laws of Management Applied to Manufacturing.* New York: Ronald Press, 1928, p. 32. Also Dexter Kimball. *Principles of Industrial Organization.* New York: McGraw-Hill, 1925. Also, The Present State of the Art of Industrial Management. *Transactions of The American Society of Mechanical Engineers,* 1912, vol. 34, pp. 1131–1229.

[6] See Bibliography, p. 69. The bibliography includes references to books and articles which throw light upon the subject even though they do not analyze it.

[7] Frank B. Gilbreth. *Motion Study.* New York: D. Van Nostrand, 1911.

[8] P. M. Elton. *Analysis of Individual Differences in the Output of Silk Weavers;*

But output is not an adequate measure of skill in any strict sense, nor has it been assumed to be so. The steadiness of the worker at his work, his habits centering about his work (such as the arrangement of his tools and materials), his attitude toward his work, depending in part upon his temperament and his response to his situation—all these conceivably may affect the quantity of his output. Even where the measurement is taken over a limited period and under controlled conditions, it must necessarily still be only of quantity of the worker's product, or, at best, of the speed with which he works, and not at all of the specific skill which he uses.

Closer to the problem have been the efforts of certain psychologists to analyze the essence of learning in muscular performance.[9] Curves of learning have been established with their accelerations and plateaus which have almost become norms in the study of the learning process. But analysis of the skill finally attained in the developed performance is still insufficient.

Aptitude testing is, in a measure, related to the analysis of skill. The effort, through tests, to discover and to grade motor capacities has received much attention from students of vocational selection and guidance. But their research has centered in the study of native capacities for muscular and mechanical performance.[10] And native capacity is not skill. Skill, by the definition of this study, is the result of trained or practised ability.

Objective tests for so-called skilled performance have also been attempted and with a measure of success. But again, to note the existence of a performance exhibiting skill in the performer and to analyse the content of the skill exhibited are quite different things, and though some effort is being made at present to do the latter, no published results are currently available.[11]

A valuable series of studies on the transferability of skill is in process under the direction of T. H. Pear.[12] These are vital to any discussion of the problem and will be considered in

and H. C. Weston. *A Study of Efficiency in Fine Linen Weaving.* Industrial Fatigue Research Board Reports, Nos. 17 and 20. London, 1922.

[9] See, for example, W. F. Book. *The Psychology of Skill.* New York: Gregg, 1925, chapter II; James H. Leuba. Learning to Make Hand Movements. *Psychological Review,* 1905, vol. 12, p. 351; W. L. Bryan and N. Harter. Studies on the Telegraphic Language. *Psychological Review,* 1899, vol. 6, p. 356; J. C. Chapman. The Learning Curve in Typewriting. *Journal of Applied Psychology,* 1924, vol. 3, pp. 252–268.

[10] See, for example, B. Muscio. Motor Capacity with Special Reference to Vocational Guidance. *British Journal of Psychology,* 1922–23, vol. 13, pp. 157–184; J. L. Stenquist. *Measurements of Mechanical Ability.* New York, Teachers' College, Columbia University, 1923; F. L. Keane and J. O'Connor. A Measure of Mechanical Aptitude. PERSONNEL JOURNAL, 1927, vol. 6, no. 1, pp. 15–24; and L. D. Anderson. The Minnesota Mechanical Ability Tests. PERSONNEL JOURNAL, 1927, vol. 6, pp. 473–478.

[11] The National Institute of Industrial Psychology of Great Britain is working along this line.

[12] Compare J. N. Langdon and Edna M. Yates. An Experimental Investigation into Transfer of Training in Skilled Performance. *British Journal of Psychology,* 1928, vol. 18, no. 4, pp. 422–438.

more detail later. Despite this excellent beginning, however, the study of skill is in its infancy.

MASS PRODUCTION AND SKILL

Mass production, contrary to popular opinion, is not a new characteristic in American industry. A recent book on industrial methods[13] states that it started with one Simeon North, a manufacturer of pistols from 1799 to 1852. But however early its start, the real development of mass production, with its attendant train of industrial changes, bringing the necessity for specialization on the part of the worker, has taken place within the last twenty-five years.

The influence of automatic machinery, on the skill of the workman has been under immediate discussion for something over fifteen years.[14] The debate has been, sometimes, very earnest. On the one side range some of the keenest critics of present-day industrial development.[15] They point to its complex organization, its subordination of product to profit, its consequent feeding of large amounts of standardized product to constantly stimulated markets, its specialized division of labor and semi-automatic machinery—in short, to the primary characteristics ascribed to mass production—and they show how work has often been reduced to a routine performance of simple and easily learned actions constantly repeated. They picture the mass of the workers, who lost the ownership of their tools a century ago, as having now lost possession of their skill, the last and most vital part of their "laborers' capital." The man operating the machine has become a "cog in the wheel," they say, without chance for initiative, self-expression, or even trained ability which is not easily displaceable at any moment.

On the other side range the equally intelligent observers (and in some instances they are closer to the problem), who point to the amazing intricacy and relative perfection of certain modern industrial products, to the consequent high degree of accuracy in workmanship obtaining, and to the special dexterity in one form or another necessary to the workman producing them. To belittle the skill of certain of these modern workmen, they claim, is comparable to an assumption that the modern specialist in surgery or medicine is less skilled than his predecessor, the general medical practitioner, because he concerns himself with a lesser portion of the human body.

Obviously both these arguments contain something of truth. The fault lies in an assumption that either describes the entire situation. Modern industry is a broad field of action with complex and even contradictory developments within it. Observations and criticisms applying to certain por-

[13] L. P. Alford. Previous citation, p. 53.

[14] The first of the papers considering the transfer of skill published by The American Society of Mechanical Engineers, No. 1378, was published in 1912.

[15] For one of the best of these criticisms see Thorstein Veblen. *The Instinct of Workmanship and the State of the Industrial Arts.* New York: Viking Press, 1914; also Helen Marot. *The Creative Impulse in Industry.* New York: Dutton, 1918; and R. M. Fox. *The Triumphant Machine.* London: Hogarth Press, 1928.

tions of automobile manufacture, which may be characterized by mass-production methods, may not at all, at present, fit the manufacture of electric-power machinery, where a similar degree of standardization and specialization is not possible. Nor can it be assumed that the two will ever be alike.

To determine the place of skill and the amount of it required under the various methods of production, and to analyze it into its constituent elements will be a difficult task. For skill has not yet been measured. No unit of measure for it has yet been conceived. But the student of industry faces the necessity of attacking the problem of its analysis and measurement. Skill is a vital factor in the effect of mass-production upon the workman producer, and in that effect lies the challenge to the student of industrial conditions.

A BEGINNING OF SKILL ANALYSIS

To attempt an analysis of skill is to set sail on an almost uncharted sea. Mr. Pear, whose definition has already been given, has suggested a classification which is helpful.[16] He has listed five grades of industrial skill:

1. *Collections of imperfectly adapted responses*, imperfectly adapted, that is, to the situation which evolves them;
2. *Perfectly adapted responses which do not exhibit personality;*
3. *Responses resembling habits but less specific and automatic*, that is, capable of rapid adjustment to a new situation such as would seem to be neither mechanical to the observer nor unconscious to the performer;
4. *Responses like those in 3, but exhibiting in their totality a pattern characteristic of the individual;*
5. *Creative skill, both (a) unconscious and (b) resulting from a deliberate analysis of earlier attempts which would be satisfactory to most persons but are unsatisfactory to the creative genius.*

Most types of industrial skill today would seem to come under the second, third and fourth of these grades. The first suggests a state of skill unsatisfactory to the situation except in the case of the learner. If it were an extended state, it would hardly fulfill the requirements necessary for any modern industrial situation, however simple the work done. The last grade, though often assumed (whether or not correctly) to be the primary element in earlier forms of craftsmanship, probably has a comparatively small place, among manual workers at least, under present industrial organization.

A more recent publication of Pear's[17] suggests that the term skill should not be applied to the first two of his classifications. To the omission of the first, this writer certainly would agree. And the second refers to a type of trained ability which might possibly be termed proficiency or even dexterity rather than skill. The line of distinction between proficiency or dexterity and skill can never be a clean-cut one, however. And the higher grades of the former must certainly shade into

[16] T. H. Pear. The Nature of Skill. Previous citation. Also, Skill. Previous citation, pp. 488 and 489.

[17] T. H. Pear. Rationalization and Its Influence on Industrial Relations. The Nature and Present Position of Skill in Industry. *The Highway*, February 1929, vol. 21, p. 70.

the lower grades of the latter. The inclusion of the second of the five classifications, therefore, *the perfectly adapted responses which do not exhibit personality*, might well, for the present, be tentative.

But these classifications, suggestive as they are, still are too general for detailed or specific evaluation. In the interest of both speech and thought upon the subject, an effort at such evaluation is needed.

2. A TECHNIQUE FOR EVALUATING SKILL

THE PURPOSE AND METHOD OF THIS STUDY

The purpose of this study originally was to discover, in specific terms, the relation between skill and specialization in industry. But since no tool was at hand with which to evaluate skill, it was necessary to forge one for the purpose as the project advanced. Of necessity, therefore, the purpose of the study became primarily an attempt to evaluate specific instances of industrial skill, and secondarily an investigation into the relation between skill and the degree of specialization under which it was found. Part II of this study, which will appear in the next issue of the PERSONNEL JOURNAL, will discuss the secondary purpose of the study under the title, "The Significance of Skill."

In an attempt to evaluate skill, at least two alternatives are possible theoretically. The first is to discover a unit and to measure the unknown quantity in terms of that unit. The second is to attempt an analysis of the component parts of the unknown (skill, in this instance), and to discover from specific examples of it a relative grading in terms of the component parts. This latter is the method used in the development of intelligence tests, where, without defining intelligence in precise terms, an attempt at evaluation is made by a grading based on various performances indicating it. The evaluation is expressed in terms of a relation to discovered norms based on a large number of cases.[18] While it would not be appropriate to discuss here the successes and failures of intelligence tests, it is permissible to point to them to show the possibility of a profitable and suggestive if not infallible evaluation on such a basis, even when a precise definition of what is being evaluated repeatedly fails of acceptance.

This study has attempted to evaluate skill, therefore, on the principle that a method for measurement may prove to be useful even when it precedes a precise definition of the matter measured. The method used, however, was not comparable to methods of intelligence testing. As previously suggested, the many tests to discover and to grade motor capacity are comparable to intelligence testing. This

[18] C. Spearman. *The Nature of Intelligence and the Principles of Cognition.* London: Macmillan, 1923; also G. H. Thompson. The Nature of General Intelligence and Ability. *British Journal of Psychology*, 1924, vol. 14, pp. 229–235; also E. L. Thorndike, E. O. Bregman, M. V. Cobb, E. Woodyard and others. *The Measurement of Intelligence.* New York: Teachers College, Columbia University, 1926.

study made no attempt to discover or to grade either general or specific inherent capacities. It attempted (1) to isolate certain instances of actual performance and to analyse them in specific terms, and (2) to investigate the relation between skill and the degree of specialization under which it was found. The term skill is used, in this study, to refer to a quality of the workmen, never to a quality of a machine or to a characteristic of the work done. It is considered a personal and a human quality. The skill discussed is the skill of workmen shown on a particular piece of work. In industrial terms, it is *skill on the job*. The skill observed is that based on Pear's definition as outlined at the beginning of this chapter, i.e., *the integration of well-adjusted performances adapted under varying situations to the attainment of a desired result.* As applied directly to an industrial process, the definition was interpreted to mean the adaptation of a man's capacities and abilities, such as are suitable, to the *job* he performs. It included the habits which he had built into that performance; it included also the ability to vary the habits in accordance with a specific need for the accomplishment of a specific result—that is, the satisfactory making of a product, or of whatever portion of it was allotted to him. The so-called "unskilled job" was one requiring little or no adaptation. (It is difficult to imagine any industrial job not requiring some integration of adjusted response from its performer.) The so-called "skilled job" was one which required a high degree of adaptation.

Though the definition of skill on the job is still necessarily couched in general terms, the method of this study was specific. The definition can therefore serve only as an introduction to the problem and as a touchstone for further development. Conceivably a rather large amount of change in the definition or disagreement as to its meaning might occur without vitiating the practical value of the analysis of *skill on the job* here attempted.

TYPES OF PLANTS SELECTED FOR STUDY

The study was one of types. It sampled, in the metal trades, an industry which contains widely different developments in organization and types of product, yet which uses many similar processes. The plants selected were as representative of the industry as possible, but offered opportunity for comparisons. They produced goods and utilized processes that allowed degrees of standardization of product, mechanization of process and specialization of work varying from plant to plant. The plants studied (Hess Bright Manufacturing Company, Leeds Northrup Company, Stokes and Smith Company, and Westinghouse Electric and Manufacturing Company) were of the better type of metal-manufacturing concerns in Philadelphia, judged by a study of quality of product, conditions of work and industrial relations, and were prominent members of the Metal Manufacturers' Association. They belonged to three of the five of Bezanson's classification of machine-shop and pressed-metal-work establishments,[19] namely: (1)

[19] Anne Bezanson. Labor Market Comparisons: Turnover Rates in Four Metal-Manufacturing Centers. JOURNAL OF PER-

the machine shop with foundry, making heavy machinery, hydraulic and textile machinery, condensers and the like; (2) the light machine shop without foundry, making light textile and paper-box machinery, electrical devices, etc.; and (3) establishments making light pressed-metal and electrical instruments.

It seemed advisable to select plants whose working conditions, both physical and social, were such as would reduce to a minimum the variables attendant upon field research. Thus, the four firms chosen were all housed in modern, well-built and well-equipped factory buildings. All were located in thriving but not crowded manufacturing districts, with space surrounding the buildings for lawn, playing fields and parking. All were kept in good condition inside and out, and each had an attractive appearance. The managements of all were, in general terms, liberal and forward looking, businesslike in their attitude toward shop employees, but sympathetic with matters of concern to them. Industrial relations gave every evidence of being harmonious and reasonably satisfactory to all parties.

The work selected was performed in the light machine shop in each plant. Particular effort was made to choose machines of comparable type from shop to shop, requiring comparable degrees of skill from the workmen, and at the same time to obtain a representative sample of the machines used in each shop. The differences which occurred were mostly those arising from variation of product, especially those arising from standardization and consequent specialization, and from variation in size of part made.

The workmen chosen represented a good average in skill and output, based on the judgment of the management. Usually they were the successful workmen; occasionally they were below the average; more often they were above it. They were not, however, solely the best workmen.[20] Where a variety occurred in the work they did, an effort was made to choose a typical job for observation and analysis, and, where a satisfactory type was not obtainable, to select more than one job. Both set-up and operation of machine were used.

A total of 75 workmen were finally included in this report, working upon 11 types of machines, in 4 plants. The machines selected include the punch press, drill press, grinder, planer, milling machine, engraving machine, grooving machine, horizontal boring mill, hand-screw machine, and engine and turret lathes. The processes selected consisted of cutting, turning, boring, grinding, and similar operations. From one plant some assembly work was also studied, but in analysis it was never used in comparison with the selected work of the other plants.

MOTION STUDY THE BASIS OF THE TECHNIQUE

The method of study included, in the first place, a careful job analysis through an adaptation of the Gilbreth

SONEL RESEARCH, 1927, vol. 5, no. 10, pp. 387–404.

[20] Tables in an Appendix to this article, which will appear in the next issue of the PERSONNEL JOURNAL, will give detail.

PROCESS CHART

Machine: Horizontal Boring Mill Part: Cylinder Cover

Operation: Finish Bore and Chamfer

Piece on table in place

1. Puts table in place for boring 3″ holes
2. Measures for length of cutter
3. Goes to tool chest and gets cutter
4. Inserts in bar
5. Steps to side and turns bar so that cutter is even with hole
6. Measures
7. Moves bar back
8. Picks up B. P. and examines
9. Steps to side and moves bar in place again
10. Sets feed and speed
11. Feeds by hand
12. Measures
13. Changes feed and starts motor
14. Moves just above bar
15. Examines B.P.
16. Inspects boring
17. Stops and measures depth of cut
18. Moves tool out and measures more carefully
19. Starts speed and feeds again to cut a bit more off
20. Stops and measures
21. Starts feed and speed
22. Stops and measures
23. Moves table
24. Measures depth of cut
25. Measures diameter
26. Fixes tool to cut off a very fine layer more
27. Starts motor
28. Stops and measures
29. Fixes cutter
30. Starts
31. Stops
32. Sets speed and starts motor
33. Stops and measures
34. Fixes cutter and starts motor
35. Stops and measures
36. Starts
37. Stops and measures
38. Moves table and stops
39. Measures diameter with inside micrometer
40. Starts
41. Looks at B.P.
42. Examines hole and measures
43. Moves table and cleans shavings out
44. Measures
45. Goes to tool chest for file
46. Files outside surface
47. Measures
48. Takes B.P. and goes away
49. Brings back foreman to inspect

Proceeds to bore next holes

FIG. 1

technique of motion study. Gilbreth motion study is familiar to industrial engineers and industrial psychologists. It is fully described in *Applied Motion*

Study,[21] so only a brief statement of it is made here. It begins with recording into what is called a process chart, accurately and in order of sequence, every significant movement made by the person studied (See fig. 1). Where the movements are too rapid for the eye to follow, or where a high degree of accuracy in the time consumed for each motion is desirable, the micro-motion film secures a moving picture of the operation. A micro-motion clock records the times in $\frac{1}{2000}$ of a minute, or a "wink," as the picture is taken. The movements are then analysed into what the Gilbreths have called "therbligs," that is, their analysis of a workman's motions entering into any industrial process. The therbligs as the Gilbreths have used them are shown in the accompanying tabulation.

Each therblig has a symbol to facilitate its use and a color or standardized cross hatching to aid its charting. The therbligs are entered upon a chart which records the elements of motion and their times vertically, and the various working members of the body horizontically.[22] This chart is called the simultaneous motion-cycle chart, or simo-chart. (See fig. 2, first three columns.) It gives a complete visualization, therefore, of the various

Search	
Find	
Select	
Grasp	
Position	
Transport loaded	
Assemble	
Use	
Dissemble or take apart	
Inspect	
Prepare for next operation or preposition	
Release load	
Transport empty	
Wait (an unavoidable delay)	
Wait (avoidable delay)	
Rest (for overcoming fatigue)	
Plan	

[21] Frank B. and Lillian M. Gilbreth. *Applied Motion Study*. New York: Macmillan, 1917.

[22] Frank B. and Lillian M. Gilbreth. Previous citation, chapter 3.

SIMULTANEOUS MOTION-CYCLE AND SKILL CHART

Machine: Horizontal Boring Mill — Part: Cylinder Cover

Operation: Finish Bore and Chamfer

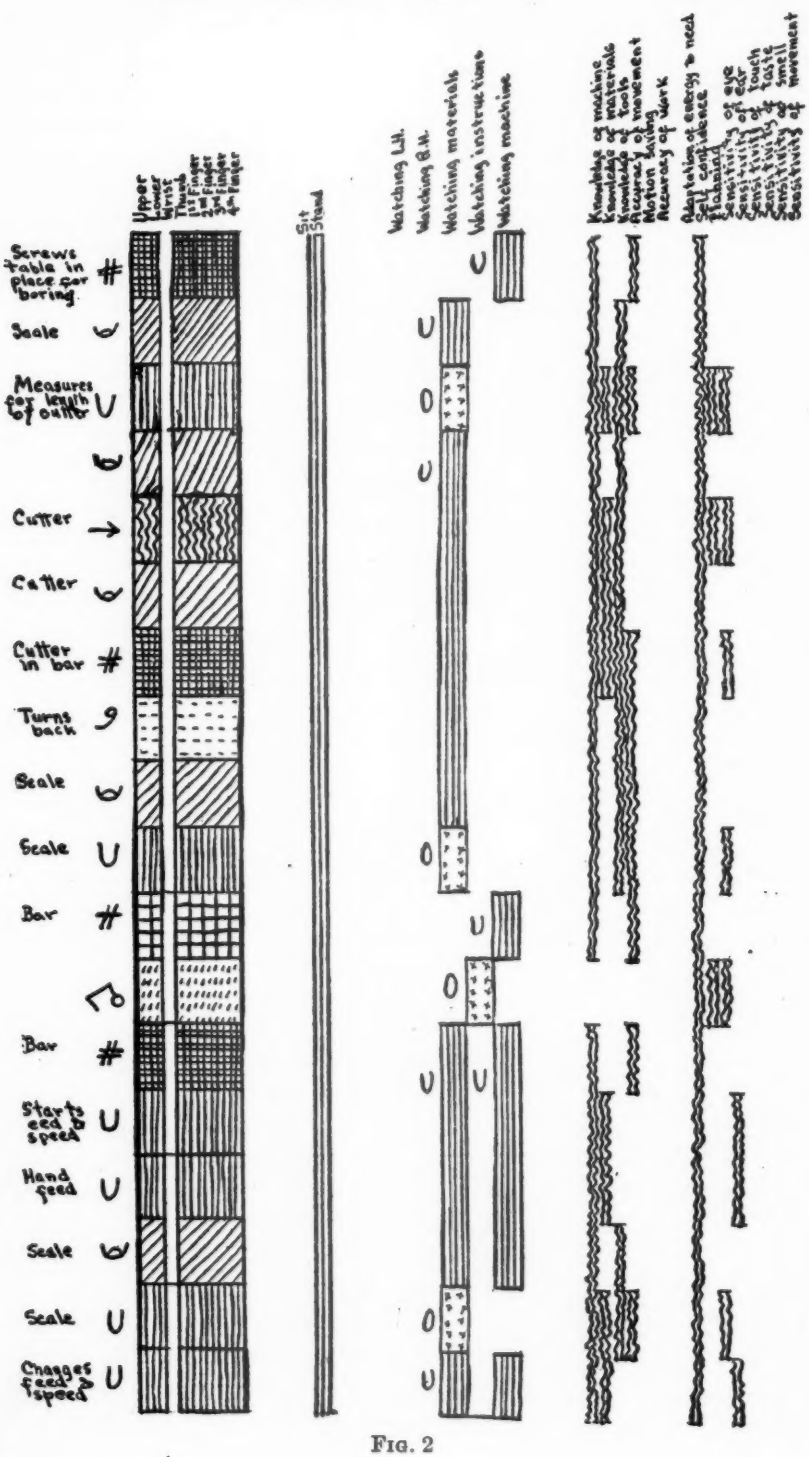

FIG. 2

members of the body engaged in performing the operation, the elements of motion used by these various members, and the relative and actual time consumed by each element of motion.[23] Figure 2 shows under "arms," "posture," and "eyes" the method of the simo-chart as the Gilbreths have used it.

The motion-study technique, adapted to the requirements of this study, yielded an analysis of the job in terms of therbligs. Process charts were made by the investigators of all the selected jobs. These in turn were analysed into simo-charts, the unit of measure being a therblig of uniform and arbitrary length. The time element, except in a few special cases, was omitted, lest the timing be confused, by the men observed, with the time study used in all of the plants for wage-rate setting. Motion pictures were taken in all of the plants, however, for experimental purposes. They will be discussed in Part II of this article, in the next issue of the PERSONNEL JOURNAL.

AN ANALYSIS OF SKILL INTO SKILL-FACTORS AND THE SIMO-SKILL-CHART

The analysis of skill and its charting are possibly a logical development of the Gilbreth technique. They are, however, original with this study. The analysis of skill into definite and observable elements of skill-factors was an attempt to put into concrete and usable form a phenomenon which had heretofore been considered too intangible for specific treatment. The analysis developed, expressed as nearly as possible in terms of industrial usage, was based in part upon the outlines of certain apprenticeship courses available for the study,[24] in part upon a classification of skill worked out by one of the plants studied,[25] in part upon the statements of various shop superintendents as to machine-shop practice, and in part upon the observation of the investigator assisted by engineers in the Gilbreth laboratory.

The result amounts to a carefully prepared method of skill notation whereby the various aspects of a workman's skill may be observed and isolated. No satisfactory method for measuring the amount of any skill-factor observed was developed so that the existence of a skill-factor in an unmeasured degree only was noted.

The charting of the skill observed through the notation of the skill-factors was developed into the simultaneous motion-cycle and skill chart, or the simo-skill-chart, as it might be called. It consisted of the Gilbreth simo-chart, supplemented by a skill notation, whereby each skill factor observable in a workman performing a selected job was charted along side of the motion or therblig to which it belonged, thus relating the skill factors observable to the elements of the industrial operation during which they ap-

[23] Frank B. Gilbreth. Motion Study for the Crippled Soldier. *Journal of the American Society of Mechanical Engineers*, 1915, vol. 37, p. 669.

[24] Apprenticeship Courses of the Metal Manufacturers' Association of Philadelphia and of Westinghouse Electric and Manufacturing Company.

[25] Westinghouse Electric and Manufacturing Company, South Philadelphia, Pa.

peared.[26] The skill-factors were arranged horizontally. Their relation to the therbligs, and, in the few cases where film charts were available, to their times of use, were arranged vertically.[27]

The analysis of skill into its skill-factors and the symbols representing each are as follows:[28]

Adaptation to machine.....
Adaptation to materials.....
Adaptation to tools.....
Accuracy of movement.....
Motion saving.....
Adaptation of energy to need.....
Self confidence.....
Plan.....
Sensitivity of eye.....
Sensitivity of ear.....
Sensitivity of touch.....
Sensitivity of taste.....
Sensitivity of smell.....
Kinaesthetic sensitivity.....

Adaptation to machine refers to the workman's neuro-muscular reactions arising from his use of his machine, his habits and knowledge which enable him to regulate, operate and utilize it in accordance with its capacities.

Adaptation to materials refers to his knowledge of the materials with which he works as built up by his handling of them, and his consequent appreciation of their idiosyncracies and requirements; that is, of the speeds and feeds which are suited to their manipulation.

Adaptation to tools refers to his power of discrimination in the use of specific tools to accomplish specific ends, their choice, placement, use and upkeep.

Accuracy of movement represents his ability to direct a movement without error and with control,—a performance adapted to a given need.

Motion saving signifies his ability to place materials and tools in ways which shall facilitate their handling.

Adaptation of energy to need refers to his use of energy nicely suited to requirement, without waste, or beyond a minimum exertion which is adequate to the purpose.

[26] The plan for charting the skill and the symbols used were devised by Annie Shaw.

[27] An effort was made to chart in parallel columns the skill developed by training, that developed by experience through following directions, and that developed by the workman's own initiative, but it proved unsuccessful. A better distinction would be one more closely in line with Pear's classification into grades of skill given a few pages back.

[28] Compare characteristics of skill included among the skill-factors with Pear's division of skill into "propria" and "accident" factors in the concluding pages of this study in the next issue of the PERSONNEL JOURNAL.

SIMULTANEOUS MOTION-CYCLE AND SKILL CHART

Machine: Blanchard Automatic Part: Outer Race Ball Bearing

Operation: Surface Grinding

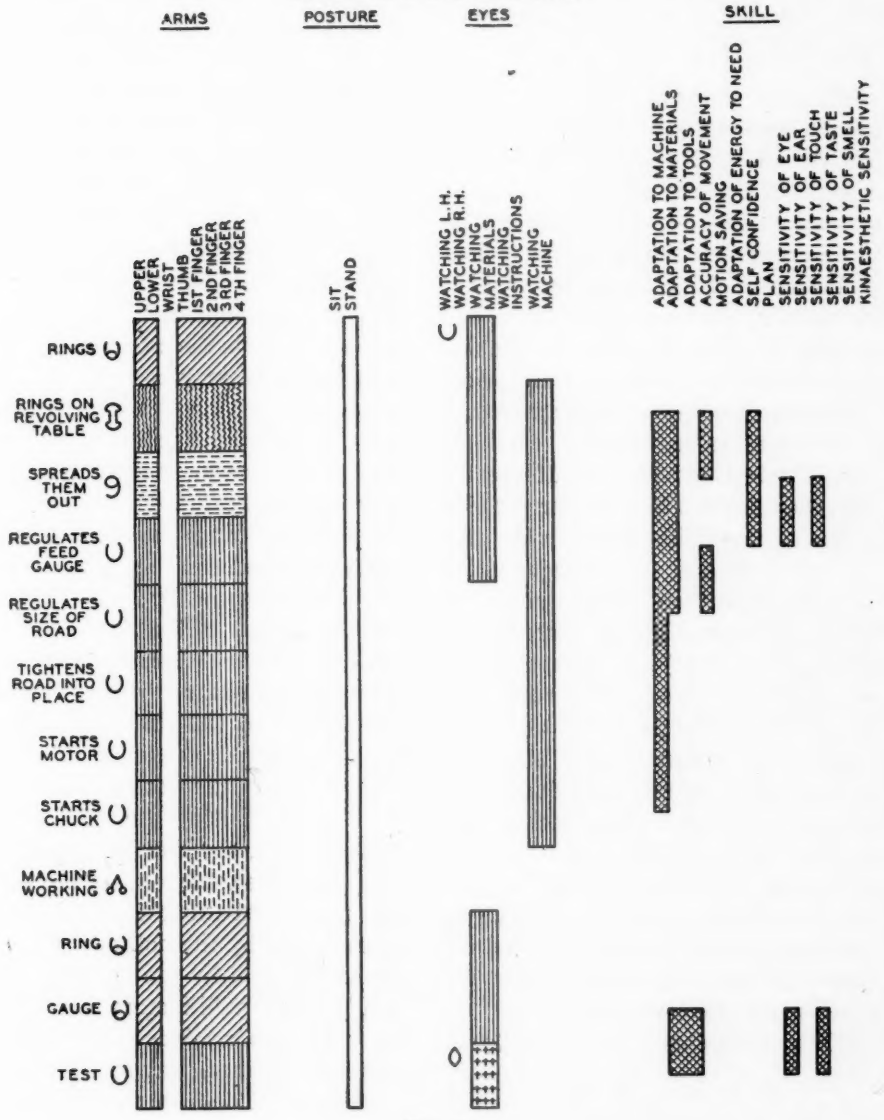

FIG. 3

Self confidence represents his ability which rises from mastery of technique or knowledge of operation to proceed without hesitation or fear directly to the conclusion of a performance.

Plan refers to his ability to prepare and to organize in advance the various neuromuscular "sets" required for a particular performance; a prepositioning of the organism.

The sensitivities of eye, ear, touch, etc. refer to the developed power of discrimination of the given sense organ or organs trained by habitual use to test a given muscular procedure.[29]

The simo-skill-chart presents, therefore, a picture both of the job performed, and of the skill shown by the workman performing it.[30] Illustration will make the method clearer. In the chart shown (see fig. 3), an operation is pictured upon a surface grinder, in which a ring for a deep-groove ball bearing is ground in a Blanchard automatic machine. The operator places a number of rings on the large tray of a revolving table, called the chuck. He spreads them out rapidly seeing that each lies flat in a proper position to meet the grinding wheel. He then (1) regulates the feed gauge of his machine which determines the rate at which the rings shall pass across the grinding wheel; (2) regulates, to fit the size of the ring, the track or road upon which they must pass; (3) starts the motor of his machine; and (4) starts the table revolving to carry the rings under the grinding wheel. The machine carries on the rest of the operation, so that the only further requirement from the workman is to test a ring with his gauge at the finish of the operation to make certain that the grinding has been correct.

The process chart, (fig. 1) analyzed the operation in detail. In making the simo-skill chart from the process chart, the steps of the operation appear in detail at the left of the chart. (See fig. 3). Each movement is pictured by its appropriate therblig, which is represented as a unit of uniform but arbitrary length. The skill which the workman exhibits during the performance is charted at the right of the chart. Each skill-factor observed during the course of any particular movement is charted opposite the therblig which represents the movement.

In this process recorded in fig. 3, during the first two movements, that is, during the transporting of the rings from the tray in which they are brought (designated on the chart by the notation "rings" and the therblig "transport-loaded"); see page 39 for symbols representing the therbligs and the placing of the rings upon the revolving table (designated on the chart by the notation "rings on revolving table" and the therblig "preposition"), no skill as defined in this study is displayed by the workman and none is charted. During the third movement, that is, the arrangement of the rings upon the table to meet the grinding wheel of the machine (designated on the chart by the notation "spreads them out," and by the therblig "position"), four skill-factors are noted: adaptation to machine, adaptation to material, motion saving, and self-confidence. These are charted as units of skill opposite the therblig "position." During the next movement, the regulating of the feed gauge, (designated on the chart by the notation "regulates feed gauge" and by the therblig "use"), five skill-factors are noted; adaptation to machine, adaptation to material, self-confidence, sensi-

[29] Further discussion of these definitions will occur in the course of the presentation.

[30] See also, for a description of this method: Mildred Fairchild. Study of Industrial Processes as a Tool in the Training of Social Workers. *Proceedings, The National Conference for Social Work,* Memphis, Tenn., 1928, pp. 577–586. Certain changes of terms used in this article have been made as being more in accordance with precise meaning.

tivity of eye, and sensitivity of touch. These are charted opposite the therblig. The analysis of the entire operation follows along the same line, as the chart indicates. Charting the eyes under the column "eyes" employs the therblig symbols and follows the regular procedure of the simo-chart. The only significance of the eyes in this operation, other than their regular use (designated on the chart by the therblig "use," lies in the therblig "inspect," at the close of the operation when the ring is tested.

THE THERBLIG-SKILL-AVERAGE

When the chart is completed, the number of therbligs employed and the number of skill-factors noted (each skill-factor used during the course of one therblig being counted as a unit) are totaled. The total number of skill-factors charted, divided by the total number of therbligs charted, gives the average number of skill-factors observed per therblig, or the therblig-skill-average of the workman. In the chart pictured (fig. 3) the total number of therbligs is 12, the total number of skill-factor units is 20, and the therblig-skill-average amounts to 1.67. Decimals were carried to three places and corrected to two.

The skill shown, it must be remembered, is not simply the observation of the skill required for the performance of that operation, nor of the individual skill of the workman performing it beyond the minimum requirements of the job. It is the sum of both these; it is the observation of the total skill shown in performance. The performance is that of a man who, in the judgment of the management, is a "good-average" workman, on a job typical of light machine-shop work in each plant.

THE RELIABILITY OF THE METHOD OF RESEARCH

The investigators were assigned, one to each of three plants and two to the fourth or largest of the plants and the one containing the most elaborate operations. A number of devices were used to achieve reliability and validity in the method of research. (1) Careful training in the making of process charts and the use of the therblig in simo-charts was given by Dr. Gilbreth herself. (2) The work of the students was supervised and checked meticulously in the seminary by Dr. Kingsbury. The analysis of the skill-factors and the nature of the skill to be observed were discussed constantly in the laboratory, while the method of simo-skill-charting was experimented upon within the group as it was developed. All simo-skill-charting was done in the laboratory and under careful supervision. (3) The writer served as director of field and laboratory research. She worked with an investigator in one of the plants and observed the others throughout the course of the study. She provided a connecting link between the other investigators and between factories, and she supervised laboratory work to see that it was as uniform and as consistent as possible. (4) Finally, moving pictures were taken of two operations in each plant, in accordance with the Gilbreth micromotion film technique, and the films were analyzed and charted into simo-skill-charts in order to verify the accuracy of the investigators' work.

Four safeguards were thus used to secure as great a degree of reliability and consistency as possible. At the close of the study any charts which seemed, in spite of previous efforts, to contain inconsistencies were rechecked either by the original investigator, or by another investigator who already was, or became familiar with the technique and the operation charted.

Even with such safeguards, a considerable degree of subjectivity necessarily was present in the observation and judgment of skill-factors. An effort was made to develop a completely objective definition of each skill-factor and of how it could be detected. The effort aided materially in the study but it was not possible to develop it to the point desired during the course of this study. Another time it should be continued for a more complete application. The results of the charting, nevertheless, were uniform enough to warrant their careful analysis and interpretation.

THE TWENTY-FOUR-HOUR PICTURE OF THE WORKMAN

Supplementing and verifying the simo-skill-chart study of the workman and his job, the investigators carried on a sociological investigation both into the conditions of work and into what was termed the "twenty-four hour picture of the workman." The first was accomplished by a rapid but careful plant survey on the basis of a factory schedule prepared for the purpose.[31] The second was obtained for the most part by interviews with the workmen, but was supplemented at certain points by the employment records of the firm, and at certain other points by the statements of the management, superintendent, foremen, employment manager and plant nurse. The information about the workmen was summed up in the workers' schedule also drawn up for the purpose.[32]

The handling of the schedule information was facilitated first, by tabulating the obtained facts in the usual fashion, and, second, by totalling the ratings given and reducing these totals to a percentage basis, considering the total score possible under the rating scheme as 100. A detailed discussion of each rating will be given in Part II, so that further explanation at this point is hardly necessary. The material was by this treatment available for statistical comparison and correlation as well as for case study.

The material of the study thus resolved into two forms: first, the simo-chart of the jobs and the skill shown in their performance, and second, the schedule based on the interviews with the workmen. With such a mass of material for even a limited number of cases, the analysis and interpretation of the information secured constituted a serious problem. The nature of the study demanded both case treatment and statistical analysis. The two methods were used to supplement each other throughout the study.[33]

[31] See Appendix A, page 57. Certain schedules for the study of personnel methods in use in the Carola Woerishoffer Graduate Department, Bryn Mawr College, and the Gilbreth schedule for the study of fatigue were used as a basis for framing the schedules for this study.

[32] See Appendix B, page 64, for workers' schedules.

[33] Much argument has occurred within recent years over the case method versus the statistical method for social research. This study demonstrates the natural dovetailing of the two methods, each for its respective purpose.

3. THE SKILL-INDEX

The first step in analysis of the material acquired for this study was to obtain from the simo-skill-chart an index of the skill of the workman in relation to his job. The therblig-skill-average supplied the means, and the ratio of the therblig-skill-average of each man to a norm therblig-skill-average of the group of workmen to which his work was comparable, supplied the skill-index needed.

The method of obtaining the norm therblig-skill-average is of importance. The sum of all the skill-factors observed among all the men of the class to be compared was divided by the sum of all the therbligs appearing in their operations, thus giving norms based upon much larger numbers of units than the number of men or of operations in the class, in some cases running into the hundreds and thousands. The norm used was thus a better type of norm, even with the limited number of cases studied, than a mean of the therblig-skill-averages of the men could have been, and was more statistically sound.

THE FORMULAE FOR THE SKILL-INDEX

Thus the formula for the skill-index reads:

$$\text{S.I.} = \frac{S}{T} \div \frac{\Sigma S}{\Sigma T}$$

where S.I. = skill index
S = units of skill on one job
T = therbligs on one job
ΣS = total units of skill in all operations under comparison
ΣT = total therbligs appearing in these operations

By relating the therblig-skill-averages to a common base, a series of three indexes was established. The first index relates the workman's therblig-skill-average to the average for all the men on similar machines. The subscript 1 indicates that the index series refers to work on the same machines within the same shop.

Formula 1:

$$\text{S.I.}_1 = \frac{S}{T} \div \frac{\Sigma S_1}{\Sigma T_1} = \frac{S \times \Sigma T_1}{T \times \Sigma S_1}$$

See also footnote 34

where S = the total number of skill factors appearing in any one job performed by any one man;
T = the total number of therbligs in the same job;
ΣS_1 = the total number of skill factor units appearing in all the jobs performed by men doing similar work; and
ΣT_1 = the total number of therbligs in the same jobs.

The second index series relates the workman's therblig-skill-average to the average for all men in the shop. The same symbols hold as before; the subscript 2 designates all selected work within the shop.

[34] An effort was made to weight the various skill-factors, i.e., $\overline{\wedge}$, $\square$, etc., by the importance of these skill-factors in the total number of like operations used as a base for the index. The skill index thus became:

$$\text{S.I.} = \frac{\left[\left(\frac{S\,\overline{\wedge}}{T} \cdot \frac{\Sigma S\,\overline{\wedge}}{\Sigma S}\right) + \left(\frac{S\,\square}{T} \cdot \frac{\Sigma S\,\square}{\Sigma S}\right) \text{etc.}\right]}{\left[\left(\frac{\Sigma S\,\overline{\wedge}}{\Sigma T} \cdot \frac{\Sigma S\,\overline{\wedge}}{\Sigma S}\right) + \left(\frac{\Sigma S\,\square}{\Sigma T} \cdot \frac{\Sigma S\,\square}{\Sigma S}\right) \text{etc.}\right]}$$

The limited number of cases, whereby norms could be discovered, made the weighting unreliable for this study.

Formula 2:

$$S.I._2 = \frac{S}{T} \div \frac{\Sigma S_2}{\Sigma T_2} = \frac{S \times \Sigma T_2}{T \times \Sigma S_2}$$

The third series relates the workman's therblig-skill-average to the average for all the men included in the study in the four plants. The subscript 3 designates all work studied.

Formula 3:

$$S.I._3 = \frac{S}{T} \div \frac{\Sigma S_3}{\Sigma T_3} = \frac{S \times \Sigma T_3}{T \times \Sigma S_3}$$

SKILL-FACTORS ON DIFFERENT MACHINES

The principle on which these indexes are founded is simple enough, but the choice of the common bases for comparison immediately give rise to two questions. The first is whether there is proof that a skill-factor as it actually appears in one man's work is like the same skill-factor in another man's work. Adaptation to machine may or may not be physiologically and psychologically identical for different individuals. Certainly it is true that this method makes no effort to identify the various muscle and nerve reactions used by different persons to produce a given result. That remains, if it seems necessary, for future research. The likeness of resulting performance, however, seems to the writer to justify comparison between men doing the same work.

The second question is more serious, namely, whether there is identity between a skill-factor in work performed on one type of machine, such as the engine lathe, and the same skill-factor in that performed on another type, such as the drill press. The basis of Formulae 2 and 3 rests upon an assumption that there is, if not identity, at least an element common enough to all to make them comparable. The comparison of the workman's skill entering into indexes 2 and 3 rests on the assumption that the relation between the same skill-factors used on the different machines included in the selection is primarily a quantitative relation. That is, the nature of the skill-factor utilized to operate one machine would be comparable to that used to operate another. The primary difference between them is that a greater amount of any one skill-factor at a given moment would usually be required to operate the more complex machine, such as one of the various lathes, than would be necessary to operate the simpler machine, such as the drill press.

It will be remembered that the skill analysis and skill charting provide no satisfactory measure of the amount of any skill-factor used at a given moment. It is possible at present to note adaptation to machine in relation to a given therblig, for example, but not the amount of adaptation used. Were the amount measurable, it would certainly be found to increase with the operation of the more complex machines. But the nature of the skill-factors as shown in the operation of one machine is comparable to that shown in the operation of another.

IS SKILL TRANSFERABLE?

In the opinion of experts in machine-shop work, the nature of the skill required to perform one portion of the machinists' trade is similar to that required for another. A common element may be assumed if a transfer of

the skill attained takes place as a workman changes from one machine to another. And a certain amount of such transfer within the trade does occur, in the opinion of experts.[35]

The man who has learned to operate a drill press, for example, will transfer a large part of his skill upon it to the new operation when he begins to operate a milling machine and lathe. The new learning process will consist of that transfer plus a new increment of control necessary to handle the more difficult and complicated machine. The transfer will probably not be complete for all of the skill-factors. Adaptation to machine, adaptation to tools, and self-confidence, at least, will require some readjustment and adaptation on the part of the workman as he begins to operate the new and more complicated machine. And his success in it will depend upon his general adaptability and attitude. But for most of the skill-factors, a considerable degree of transfer may be expected.

The whole question of the transferability of skill is far from settled. Recent studies by Farmer[36] indicate a common element of accurate and rapid coördination in response to a given stimulus in certain of the higher grades of skilled performance. Moreover, within similar fields of work a transferability of attitudes and sentiments, or of knowledge of methods "where the particular function trained was the vehicle of these mental powers" has been thought probable.[37]

On the other hand, a study made at the University of Manchester, which correlated tests of production capacity on various simple operations requiring one type or another of motor skill,[38] brought out little evidence of a transfer of skill between the types of operations studied. The man who could pass one type of simple motor test could not necessarily pass another, nor did training upon one type of operation necessarily help him when he came to perform another. The operations studied, however, were very simple indeed, requiring a type of skill so elementary that it is questionable whether it could be counted as more than a manual or finger dexterity.

But the man who bores a hole in a bit of cast iron, the man who faces it, and the man who turns and trims it down are using higher grades of skill. Moreover, after careful observation and analysis, the greatest difference in the skills required upon these machines seems to rest in the amount of adaptation required.

The assumption of transferability in

[35] The writer wishes especially to thank Mr. L. C. Morrow and Mr. Fred W. Colvin, editors of *The American Machinist*, and also Prof. Joseph W. Roe, of New York University, for consideration and advice upon this topic.

[36] E. A. Farmer. A Group Factor in Sensory-Motor Tests. *British Journal of Psychology*, April 1927, vol. 17, pp. 327–334.

[37] T. H. Pear. The Nature of Skill. *Journal of the National Institute of Industrial Psychology*, October 1928, vol. 4, no. 4, p. 202.

[38] For a full description of these tests and their results, see J. N. Langdon and Edna M. Yates, previous citation. See also B. Muscio. Motor Capacity with Special reference to Vocational Guidance. *British Journal of Psychology*, 1922–23, vol. 13, pp. 157–184; F. A. C. Perrin, *Journal of Experimental Psychology*, 1921, vol. 4, pp. 24–56; and H. L. Hollingworth. *Journal of Educational Psychology*, 1913, vol. 4, pp. 405–414, quoted by Mr. Muscio.

this study, therefore, is based upon the fact that it deals with so-called higher grades of skilled performance and upon the closeness of the relation between the branches of the machine-shop trade. On that basis, formulae 2 and 3 and their resulting indexes are justified.

Nevertheless, even though the assumption of transferability of skill in this case be justified, the formulae used do not indicate the full difference in quantitative terms which exists between therblig-skill-averages shown by workmen on different machines. A study of the therblig-skill-averages by one who knows the machines will indicate, however, that the variation which exists in the quality of the skill-factors would in quantitative terms only increase the variation now apparent.[39] In other words, a quantitative weight might correct the error if a logical one could be found. Such a weight might be formed by multiplying the therblig-skill-average of the workman by the ratio between the mean therblig-skill-average of all men on one machine and that of all men studied in the shop. The weight, by such a method, while it would not measure the exact difference in skill-factors occurring, would nevertheless indicate something of their correct variation.

Formula 2 would then become:

Formula 4:

$$S.I._4 = \frac{S}{T} \div \frac{\Sigma S_2}{\Sigma T_2} \times \left(\frac{\Sigma S_1}{\Sigma T_1} \div \frac{\Sigma S_2}{\Sigma T_2} \right)$$

or,

$$= \frac{S \times \Sigma S_1 \times (\Sigma T_2)^2}{T \times \Sigma T_1 \times (\Sigma S_2)^2}.$$

In like fashion, Formula 3 would become:

$$S.I._5 = \frac{S}{T} \div \frac{\Sigma S_3}{\Sigma T_3} \times \left(\frac{\Sigma S_1}{\Sigma T_1} \div \frac{\Sigma S_2}{\Sigma T_2} \right)$$

or,

Formula 5:

$$\frac{S \times \Sigma S_1 \times \Sigma T_2 \times \Sigma T_3}{T \times \Sigma T_1 \times \Sigma S_2 \times \Sigma S_3}$$

On the bases of these formulae, $S.I._2$ and $S.I._3$ are merely a comparison of simple therblig-skill-averages with no effort to reduce them to common terms. $S.I._4$ and $S.I._5$, on the other hand, attempt to allow for the additional inherent variation within the skill-factors by a quantitative weighting system. But in the opinion of the writer the unweighted indexes are as logical as the weighted ones. Until further definite relationships between the same skill-factor on different machines can be determined by research, it is essential only that the limitations of the indexes be clearly understood.

THE SKILL INDEXES

When the indexes for all the workmen studied in the four plants are arranged in comparative order, the result is striking, as a study of Tables I and II shows at once. The therblig-skill-averages of the workmen tend to increase, with a few exceptions, from those used on the punch press, through drill press, grinders, planer, milling machine, engraving machine, grooving machine, horizontal boring mill, hand-screw machine and lathes. The order is very close indeed to the accepted grading of the machines by industrialists. Operators of turret lathes, it is true, rank higher in therblig-skill-average throughout than do those on engine lathes. But in every case the men who operate also set up the machines, so that first-rate men are employed upon the turret lathes and therefore merit the rank given them. Moreover, in both Plant C and Plant D, two of the three men operating engine lathes were not of first rank as based on their production standing, and they

[39] See Table II.

TABLE I

Therblig-skill-averages and skill-indexes of selected workmen in the four plants

NUMBER IN FACTORY	WORKMAN SERIAL	MACHINE	MACHINE SERIAL	THERBLIG-SKILL-AVERAGE	S.I.₁*	S.I.₂*	S.I.₃*
			PLANT A				
1	10	Grinder	VI d	0.79	74	32	22
2	8	Grinder	VI c	1.11	61	51	35
3	12	Grinder	VI d	1.30	121	59	41
4	5	Grinder	VI b	1.42	64	67	46
5	9	Grinder	VI d	1.66	156	76	52
6	26	Punch press	XII	1.75	96	80	55
7	28	Punch press	XII	1.83	111	84	58
8	27	Punch press	XII	1.87	102	85	59
9	6	Grinder	VI c	1.93	107	89	61
10	17	Engine lathe	IX a	2.00	86	91	63
11	20	Engine lathe	IX a	2.30	99	105	72
12	18	Engine lathe	IX a	2.36	101	107	74
13	19	Engine lathe	IX a	2.35	101	107	74
14	7	Grinder	VI a	2.25	129	107	74
15	22	Turret lathe	IX b	2.18	96	113	78
16	25	Turret lathe	IX b	2.54	98	116	80
17	3	Grinder	VI b	2.57	111	116	80
18	13	Groover	VII	2.60	93	119	82
19	4	Grinder	VI b	2.65	114	120	83
20	24	Turret lathe	IX b	2.68	104	123	85
21	21	Engine lathe	IX a	2.90	124	131	90
22	14	Groover	VII	2.88	103	132	91
23	15	Groover	VII	2.94	105	134	92
Mean.....				2.19		97.6	67.2
S.D.....						26.9	18.5
Median.....						107	74
L.Q.....						80	55
U.Q.....						119	82
Q.D.....						19.5	13.5
			PLANT B				
1	34	Drill press	IV	0.47	23	15	15
2	36	Engraver	V	0.96	40	30	30
3	43	Punch press	XII	1.33	76	40	41
4	40	Engraver	V	1.32	56	41	41
5	44	Punch press	XII	2.38	136	72	73
6	38	Engraver	V	2.77	117	85	87
7	35	Drill press	IV	2.83	136	87	88
8	39	Engraver	V	3.42	144	105	107
9	37	Engraver	V	3.53	149	108	110
10	31	Assembly	I	3.64	89	110	
11	33	Assembly	I	3.68	90	112	
12	41	Hand screw	VIII	3.75	95	115	117

TABLE I—*Continued*

NUMBER IN FACTORY	WORKMAN SERIAL	MACHINE	MACHINE SERIAL	THERBLIG SKILL AVERAGE	S.I.₁*	S.I.₂*	S.I.₃*
13	30	Assembly	I	3.94	97	120	
14	42	Hand screw	VIII	4.25	107	129	132
15	32	Assembly	I	4.35	107	133	
Mean.....				2.50		86.8	76.4
S.D.....						37.1	37.5
Median.....						105	87
L.Q.....						41	41
U.Q.....						115	110
Q.D.....						37	34.5
PLANT C							
1	45	Drill press	IV	1.40	63	43	43
2	77	Milling machine	X a	2.23	77	68	69
3	48	Engine lathe	IX a	2.30	75	72	73
4	49	Engine lathe	IX a	2.34	76	73	74
5	76	Milling machine	X a	2.37	88	73	74
6	53	Ingersol	X b	3.26	112	101	102
7	50	Turret lathe	IX b	3.17	90	101	102
8	51	Turret lathe	IX b	3.56	99	111	112
9	46	Drill press	IV	3.91	175	121	122
10	52	Turret lathe	IX b	4.47	117	131	132
11	47	Engine lathe	IX a	4.59	148	142	143
Mean.....				3.22		94.2	95.1
S.D.....						29.3	29.4
Median.....						101	102
L.Q.....						72	73
U.Q.....						121	122
Q.D.....						24.5	24.5
PLANT D							
1	58	Drill press	IV	2.20	95	63	67
2	57	Drill press	IV	2.38	98	65	71
3	59	Drill press	IV	2.15	106	70	75
4	62	Grinder	VI d	2.58	95	76	81
5	72	Milling machine	X a	2.60	76	77	82
6	64	Engine lathe	IX a	2.89	77	80	86
7	60	Grinder	VI d	2.83	104	83	89
8	74	Planer	XI	2.97	100	87	93
9	56	Horizontal bore	III	3.02	79	91	97
10	71	Milling machine	X	3.16	92	93	100
11	65	Engine lathe	IX a	3.18	90	94	101
12	70	Milling machine	X	3.31	96	97	104
13	59b	Drill press	IV	3.69	100	107	114
14	73	Milling machine	X	4.04	117	118	126

TABLE I—*Concluded*

NUMBER IN FACTORY	WORKMAN SERIAL	MACHINE	MACHINE SERIAL	THERBLIG-SKILL-AVERAGE	S.I.₁*	S.I.₂*	S.I.₃*
15	55	Horizontal bore	III	4.18	106	122	130
16	54	Horizontal bore	III	4.35	110	126	135
17	66	Turret lathe	IX b	4.29	91	127	136
18	63	Engine lathe	IX a	4.35	123	128	137
19	67	Turret lathe	IX b	4.13	92	129	138
20	68	Turret lathe	IX b	4.85	102	143	153
21	69	Turret lathe	IX b	5.89	123	172	184
Mean.....				3.41		102.3	108.5
S.D.....						29.8	28.6
Median.....						94	101
L.Q.....						78.5	84
U.Q.....						126.5	135.5
Q.D.....						24	25.75

* $S.I._1$ is the skill index process base; $S.I._2$ is the skill index factory base; $S.I._3$ is the skill index inter-factory base.

TABLE II

Therblig-skill-averages for plants and machines

MACHINES	S/T FOR GIVEN PLANT			
	A	B	C	D
Plant average (all machines).....	2.19	2.50	3.22	3.41
Punch press.....	1.82	1.75		
Drill press*.....		2.08	2.23	2.32
Grinders.....				2.72
Grinders I.D.....	2.32			
Grinders O.D.....	1.81			
Grinders Surface.....	1.07			
Planer.....				2.97
Milling.....			2.91	3.44
Engraving.....		2.37		
Grooving.....	2.80			
Hand screw.....		3.95		
Lathe,				
Engine.....	2.33		3.09	3.54
Turret.....	2.58		3.61	4.76
Horizontal boring mill.....				3.94

* These figures for Plant D do not include 59_b, the more skilled work done by one operator. The average including 59_b becomes 2.88.

brought down the average for the group below the level it would probably have reached had the workmen been the equivalent of those selected from among turret-lathe operators. The therblig-skill-averages of workmen

from machine to machine show very much the variation, that experts acquainted with the machines might expect.

A similar rise in scale is apparent in the therblig-skill-averages shown by workmen upon the same machine between plants. It should be realized here, however, that the machines are never quite the same. Difference in size of work and difference in variety of product demand considerable variation, in a turret lathe, for example, or perhaps even more strikingly in a drill press, from plant to plant. Comparisons of individuals between the plants should, therefore, be only of a general nature. On the whole it would seem reasonable to assume on the basis of therblig-skill-averages that workmen in Plant D possess a higher average skill than workmen in Plant A, and that also on like machines. A workman operating a turret lathe in Plant D may be considered as showing more skill than a workman operating a similar machine in Plant A. And the mean skill of all workman in Plant D may be considered superior to that of all workmen in Plant A.

More detailed comparison is probably not justified. Whether or not, for example, the man with a higher therblig-skill-average in Plant A is a superior workman to a man with a lower therblig-skill-average in Plant D can hardly be determined. The significance of the figures rests not so much in individual rank as in trends and averages.

Equally impressive is the wide range of therblig-skill-averages shown by workmen in each of the four plants, and the relative positions of the means and medians. The mean $S.I._3$ appears for the four plants at 67.2, 76.4, 95.1 and 108.5, with standard deviations of 18.5, 37.5, 39.4, and 28.6 respectively. The medians vary also and are somewhat comparable, 74, 87, 102 and 101, with quartile deviations of 13.5, 34.5, 24.5 and 25.75 respectively.

Two facts stand out in a study of the ranges. The first is the great spread of the unweighted inter-factory skill index ($S.I._3$). In Plant A it amounts to 70 points, in Plants B and D to 117 points, and in Plant C to 100 points. The spread is surprising in Plant A. It is a plant where skill is discounted as an almost negligible quality, and where six weeks is considered the limit of training time needed for proficiency in most of the work performed. One might reason ably expect, therefore, comparatively little variation in the skill shown. Yet the $S.I._2$ shows a range of 102 points and the $S.I._3$ of 70 points. The figures would indicate a higher range of skill among the workmen than either management or men appear to realize. The repetitive nature of the task possibly makes it so much an integral part of a man's habitual routine that he ceases often to be conscious of his performance as a skillful one.

In Plant B, the youth of a number of the selected workers (they included three apprentices) undoubtedly influenced the range here shown, and so increased the spread. Of the two lowest indexes, one is that of a youth under 20, the other of a learner not yet fully adapted to the job. The age of the selected workmen is, nevertheless, typical of the section of the plant studied.

Not all of the apprentices, however, appear in the lower ranks.[40]

Altogether, the range of the unweighted indexes is a wide one. Table III gives a frequency grouping of them which emphasizes their relation to one another.[41]

While considering the basis of the skill index, it is necessary to note that the charts from which the therblig-

TABLE III

Factory and inter-factory skill indexes of four plants

INDEXES	TOTAL	PLANTS			
		A	B	C	D
		S.I.$_2$			
Total.....	75	27	15	11	22
1–25	1		1		
25–50	5	1	3	1	
50–75	11	3	1	4	3
75–100	17	6	2		9
100–125	23	10	6	4	3
125–150	12	3	2	2	5
150–175	1				1
175–200					
Not given	5	4			1
		S.I.$_3$			
Total.....	75	27	15	11	22
1–25	2	1	1		
25–50	7	3	3	1	
50–75	17	10	1	4	2
75–100	18	9	2		7
100–125	11		3	4	4
125–150	9		1	2	6
150–175	1				1
175–200	1				1
Not given	9	4	4*		1

* Assembly indexes not included in inter-factory index.

[40] Thus, if the lower 4 in Plant B were omitted, the minimum S.I.$_2$ would be above the mean and almost at the median of Plant A, and the median would equal that of Plants C and D. Tables in an Appendix which will appear in the next issue of the PERSONNEL JOURNAL will give detail of selected workmen.

[41] The range of indexes, by the nature of the formulae, becomes greater with the weightings. And since the weight represents only the index value for each machine in relation to the rest of the plant, it offers no advantage for comparison of indexes between plants. Nor is such additional weighting possible without further research.

skill-averages here presented were formed were charts of operations upon the machines studied, not of set-ups, that is not of the preparation of the machine for operation. With certain exceptions in Plant D, where the set-up of the machine seemed an integral part of the operation, charts of the setting-up of the machine were not included in the computed skill indexes.

Such charts were made of work upon all the machines studied in Plant A—the plant which requires the most repetitive work among the four plants studied—and since in all cases among the selected workmen the set-ups were performed by the operators themseves and not by a specialist or foreman, the therblig-skill-averages shown by the charts were noteworthy. They were as follows:

Grinder, I.D.	3.04
Grinder, O.D.	3.35
	2.46
Grinder, surface	2.12
Grooving	2.65
	2.75
Lathes, engine	2.87
	2.59
	2.50
	2.83
Lathes, turret	2.96
Punch press	2.38
Average for plant	2.74

The mean therblig-skill-average, 2.74, is not much greater than that for the operations, 2.19. While it exceeds the average of Plant B, it does not approach that of Plant C, and were the set-up combined with the operation, the average would not pass that of Plant B.

At the same time, apparently, the set-ups tend to require a greater total skill from the workmen than do the operations at Plant A, a relation which in the few cases studied did not necessarily exist in Plant D. Set-up charts were not attempted at either Plant B or Plant C. Possibly, therefore, a complete inclusion of set-up therblig-skill-averages would somewhat alter the exact relation of the plants one to another. But knowledge of the shops and work would lead one to doubt whether that alteration would be extensive. Moreover, motion study of a machine set-up is not satisfactory at present. The job is entirely too long to chart effectively or conveniently, and too varied to sample.

Finally, the limited number of workmen studied from each type of machine operator makes the norms and index bases uncertain and incomplete. Under no circumstances should anyone consider these norms as absolute or conclusive, but rather as experimental and tentative.

But certain relations have stood out as extraordinarily significant, and provocative for further research. The skill-index provides and evaluation of a workman's skill in relation to that of his fellows which, though still inexact, is highly suggestive. Not only do the individual indexes seem, on the whole, close to an evaluation one might expect, but a study of their ranges and of their relation to one another presents a striking picture. The relation of the skill-indexes of workmen operating complex machines to those operating simple ones, and the variation of indexes of workmen from plant to plant are worth careful attention. They will be considered further.

APPENDIX A

SPECIALIZATION IN THE METAL TRADES AND ITS EFFECT ON SKILL AND SATISFACTION

FACTORY SCHEDULE

Introduction. History and Type

A. Approach to Plant, and Plant (general)

B. Product

C. Organization of Plant—Department
   1. Shop
   2. Management

D. Personnel
   1. Employment
   2. Training
   3. Service
   4. Benefits, Pensions and Insurance
   5. Industrial Relations

E. Process (selective). To be studied for the purpose of understanding the worker in relation to his job.
   1. Major Processes
   2. Selected Processes

A. APPROACH AND PLANT (GENERAL)

(See Gilbreth, Fatigue Survey, I, II, pp. 1–2)

I. APPROACH

1. Community
   1) Nationality.....
   2) Type: Urban.....Village.....Rural.....
   3) Population.....
2. Transportation
   1) Method: Railroad.....Trolley.....Bus.....Elevated.....
   2) Traffic condition in towns: Crowded.....Normal.....Quiet.....
3. Housing
   1) Type: one family.....semidetached.....row or group.....single duplex.....
   double duplex.....row duplex.....tenement.....
   2) Resources: Plentiful.....Normal.....Scarce.....
   3) Conditions: Good.....Excellent.....Fair.....Poor.....
   4) Ownership: Plant.....Worker.....Rented.....
4. Social Service
   1) School: Elementary.....High.....Night.....
   Continuation.....Workers or Adult.....Technical or Trade.....
   2) Recreation: Play grounds.....Societies.....
   Clubs.....Amusement places.....
   3) Churches: Denominations.....
   4) Social Service: Hospital.....Visiting nurse.....
   Family care.....Child care.....

II. PLANT

1. Surroundings: Space around works.....Used for gardening.....
   Games field.....Parking.....Nothing.....
2. Buildings: Outside
   1) Number.....2) General Condition: Crowded.....Well spaced.....
   New.....Old.....3) Repair.....

3. Buildings: Inside (Gilbreth, Pp. 17–18)
   1) Repair.....
   2) Lighting: a) Windows: Good.....Fair.....Poor.....
      b) Skylight: Yes.....No.....
      c) Adequacy: Good.....Fair.....Poor.....
      d) Quality: Good.....Fair.....Poor.....
      e) Ceiling, Wall, Floor, etc.: Good.....Fair.....Poor.....
      f) Obstructions.....
   3) Location of stairs and elevators: good.....Fair.....Poor.....
   4) Housekeeping: Good.....Fair.....Poor.....
   5) Safety devices: Adequate.....Inadequate.....
4. Entrances: For visitors.....Employment department.....
   Executive and office.....Employees.....
   Special departments.....
5. Parking places: Shed.....Enclosed space.....
   Hired by employees.....Free.....

B. PRODUCT (REPORT OR CATALOGUE)

I. CLASSES OF PRODUCT
1. Primary: List number and variety of types.....
   .....
2. Supplementary: List number and variety of types.....
   .....

II. TYPE OF ORDER
1. Standard goods.....
2. Manufactured to order.....
   1) Design specification with order.....
   2) Design by company.....

III. PRODUCTION STANDARD PARTS
1. For market.....
2. For inventory (Used to stabilize fluctuations?).....

IV. OUTPUT
1. Average quantity per month of each class (if obtainable): Primary.....
   .....Supplementary.....
2. Average value per month (if obtainable)
   1) Total.....
   2) Each class: Primary.....Supplementary.....
   3) Total value output last year (if obtainable).....

V. MARKET
1. Locations.....
2. Seasonal variations in demand:.....
   1) When peaks..... 2) When slacks.....
3. Fluctuating variation in demand.....

C. ORGANIZATION OF PLANT—DEPARTMENT

(See if firm has charts)

I. SHOP DEPARTMENTS—CHART LIST
1. General.....
2. Selected for study.....
3. Allied to those selected for study.....

II. MANAGEMENT DEPARTMENTS—CHART

1. Business
   1) Finance..... 2) Purchase..... 3) Sales.....
   4) Other.....
2. Planning: (List functions on attached sheet).....
   .....
3. Production Engineering:
   1) Time study (describe).....
      a) Methods.....
      b) Extent.....
      c) How often revised?.....
      d) Basis of payment resulting.....
      e) Job specifications included.....
   2) Other schemes.....
   .....
4. Personnel—List
   1) Employment.....
   2) Service.....
   3) Training.....
   4) Industrial Relations.....
   5) Other (specify).....

III. INTERPLANT ORGANIZATION

1. If company has other plants, fill in the following table:

	A	B	C	D	E
Name					
Location					
Product					
Size: No. employees					
Value of output					

2. Alliance with other companies.....

(Gilbreth III and the two Department Personnel Schedules)

D. PERSONNEL

I. EMPLOYEES

1. Employees:
   1) Number.....Day work.....Piece work.....
      Men.....Women.....
   2) Wages:
      a) Day work: Maximum.....Average.....Minimum.....
      b) Piece work, day earnings: Maximum....Average....Minimum.....

c) Bonus weekly: Maximum.....Average.....Minimum.....
d) Regularity: Steady.....Intermittant.....Seasons.....
3) Hours of work:
a) Number: Daily.....Weekly.....
b) Daily: Beginning.....Ending.....
c) Saturday: Beginning.....Ending.....
d) Noon hour.....e) Rest Periods.....
f) Overtime work.....g) Night work.....
2. Protections:
1) Fire:
a) Plant fire department: Permanent.....Volunteer.....
b) Municipal fire department: Near.....Far.....
2) Safety:
a) Council: Department committee.....
Safety engineer.....

II. EMPLOYMENT
1. Name of Department.....
Head.....Title.....
2. Functions Exercised.....
1) Requisition for labor needed?.....
2) Chief sources of labor supply.....
.....
3) Interview: Private?.....With others in room?.....
How conducted?.....
4) Is foreman consulted before person is finally hired?.....
5) Application blank on file for employee?.....
6) Pre-employment tests: *Physical*, for what employees?.....
How thorough?.....Purpose?.....
Trade tests, for what employees?.....
What test used?.....
General Intelligence Test, for what employees?.....
What test used?.....
7) References required, for which employees?.....
From whom?.....
8) Introduction to the job: by whom?.....
General instructions about rules, lunch rooms, washrooms, plant organization, etc.....
9) Attach copy of employment record.....

III. EDUCATION
1. Training:
1) Vestibule Schools: a) What occupations.....
b) Period of training.....
c) Wages paid.....
d) Who instructs?.....
e) Who is taught?.....
f) Equipment?.....
2) Apprenticeship system: a) List departments.....
.....
b) Number apprentices each department?.....
.....Total.....
c) How long operating.....

d) Conducted by plant alone?.....
In conjunction with Metal Trades Associations?.....
e) What per cent of present employees apprentice trained this plant?...
.....
In what departments do they work now?.....
.....
f) Describe courses (attach description or analysis).....
3) Systematic up-grade training.....
4) Other systems.....
5) Foreman training.....
6) Other education offered.....
.....

2. Follow up of New Employees:
1) Rating system (describe).....
.....
2) Tests during service.....
.....
3) Continuation of training required.....
.....
4) Other plans.....
.....

3. Transfer and Promotion System:
1) Describe method.....
2) Basis for promotion: length of service.....merit.....
3) Whose judgment used?.....
4) How are employees acquainted with opportunities?.....
.....

4. Discharge:
1) By whom?..... 2) Chief causes?.....
.....
3) System of appeal and investigation.....

5. Discipline:
1) By whom?.....
2) Causes: Non-attendance.....tardiness.....stop work early.....
other (specify).....
3) Method: fines.....
do they go to benefit of management?.....men?.....
other methods.....
4) System of appeal and investigation.....
.....

IV. SERVICES
1. Food:
1) Lunchroom: for office.....for shop.....for both.....
2) Other facilities: for office.....for shop.....for both.....
3) Kind of food: hot.....cold.....
beverages: hot.....cold.....
well prepared.....variation.....
4) Length of lunch period.....
5) Surroundings: Comfortable.....clean.....attractive.....
temperature.....light.....ventilation.....
quiet.....smoking.....

2. Health:
   1) Benefit: Paid in full.....paid in part.....
   by whom paid?.....
   2) Medical clinic: a) Doctor: Visiting.....Plant.....
   b) Nurse: visiting.....Plant.....
   c) Hospital arrangements: plant.....Outside hospital.....
   e) Examinations.....
   3) Dental clinic.....if none, dental care.....
   4) Eye clinic.....if none, eye care.....
   5) Rest Room: 1) Entire plant.....for men.....for women.....
   b) Each department.....for men.....for women.....
   c) Equipment.....
   d) Surrounding conditions: Noise.....
   Temperature.....light.....
   e) Number accommodated at one time.....
   f) Supervision.....
   6) Dressing rooms: Plant.....Department.....
   Lockers.....Books.....
   7) Lavatories: Plant.....Department.....
   Adequacy.....Conditions: good.....fair.....poor.....
3. Recreation:
   1) Room (describe).....
   a) Time used.....b) Supervision.....
   2) Clubs (name).....
   3) Athletic fields.....
   4) Library: Branch.....Private.....Librarian.....
   When available.....
   5) Other.....

V. PENSIONS, BENEFITS AND INSURANCE
1. Unemployment fund: Union.....Employees' insurance.....
   Employers' fund.....
2. Financial rewards.....Partnership: Type.....
3. Pensions.....
4. Insurance: type.....
5. Accident Compensation.....
6. Bonus for length of service.....
7. Vacation with pay: Number of weeks.....Requirements.....
   .....
8. Railroad passes.....
9. Discount on products.....
10. Coöperative buying.....
11. Building and loan.....
12. Vacation without pay.....
13 Other non-financial rewards.....
14. Banking and saving facilities.....

VI. INDUSTRIAL RELATIONS: UNIONIZATION, SHOP REPRESENTATION
1. Type of shop: open.....closed union.....closed non-union.....
   preferential.....company union.....
   industry generally unorganized.....
2. Employee representation: Form.....
   Representation.....
   Function.....

3. Trade agreement: Subjects covered.....
Duration.....Administration.....
4. Grievances: To whom taken.....
How adjusted.....
5. Method of suggestions for employees.....
.....
6. Attitude of management toward employees.....
.....
7. Attitude of employees towards management as tested out.....
.....
8. Yearly turnover:
1) Per cent new employees, including temporary employees.....
2) Average number on payroll.....
3) Attendance: good.....fair.....poor.....
4) Quality of workmanship.....
5) Per cent discharge.....per cent voluntary leaving.....
per cent layoff.....per cent absenteeism.....
6) Number employed last year (including temporary or part time employees, unless otherwise stated).....Number resigned.....
Per cent of turnover.....
7) Basis of computation.....

E. PROCESSES

I. MAJOR PROCESSES
1. List: shops and departments.....
.....
2. Attach chart if available.....

II. SELECTED PROCESSES
1. Nature of work: (check)
1) Type of work: Hand operation.....Machine operation...automatic.....
semi-automatic.....quick.....slow.....coarse.....fine.....exacting.....
non-exacting.....clean.....dirty.....dusty.....oily.....hot to touch.....
normal temperature to touch.....noisy.....quiet.....
accident risk: safe.....little danger.....dangerous.....
health risk: industrial poisons.....
steady.....irregular.....periodic.....
2) Variation of work: Hand.....machine.....Set up.....Operation.....
Type of part worked.....Size of part worked.....
Materials used.....Size of order.....
Number of operations one job.....Number set ups one job.....
Relative times required: set up.....operation.....
Relative skill required: set up.....operation.....
3) Analysis of skill:
Technical knowledge: mechanical laws.....machinist principles.....
Specific machine: operation.....set up.....repair.....
Materials worked: strength.....speeds.....feeds.....lubricants.....
Blue prints.....Measuring instruments: micrometer.....caliper.....
gauge.....scale.....vernier.....
Tools: use.....care.....repair..
Manual dexterity: accuracy.....speed.....motion saving.....
finger manipulation.....
Personality characteristics: initiative.....responsibility.....

judgment.....dependentability.....plan.....
Sensitivity: ear.....eye.....touch.....
Emotional stability.....
4) Job specification as made by plant. (Attach copy)

2. Changes in processes: (Check)
1) Increased automatic features..... 2) Combination operations.....
3) Increase quantity output.... 4) Quality of produce: increase..decrease..
5) Effect on skill needed of worker (mark increase *x*, decrease, *o*)
Technical knowledge needed:
Mechanical process.....machine.....materials.....tools.....
Manual dexterity:
Finger manipulation.....accuracy.....motion saving....speed.....
Sensitivity: ear.....eye.....touch.....
Personality characteristics:
Initiative.....responsibility.....judgment.....plan.....
dependability.....emotional stability.....
6) Effect on type of work: (mark in crease *x*, decrease, *o*)
Hand.....machine.....automatic.....
Quickness....exactingness....cleanliness....oiliness.....
heat in handling.....
7) Effect on tendency to fatigue: (mark increase *x*; decrease, *o*).....

3. Make Process Chart of Operation, or if this is impossible, list in proper sequence detail elements of operation.

APPENDIX B

WORKER'S SCHEDULE

Name.....Department.....Machine.....

A. FACTUAL INFORMATION

I. THE JOB

1. Conditions of Job: (Answer by check)
1) Space: too much.....normal.....crowded.....
2) Work place: orderly....disorderly....crowded with details.....
3) Equipment; supply: adequate.....inadequate...upkeep: good...poor...
4) Tools; supply: adequate....inadequate.....upkeep: good.....poor...
5) Heat: warm...normal...cold... 6) Ventilation: adequate...inadequate..
7) Light; of room: good..fair..bad.. 8) of work place: good..fair..bad...
Answer *Y* (yes) or *N* (no):
9) Agreeability: clean.....dirty.....dusty.....sooty.....smoky.....
10) Type of floor: concrete...wood...wood platform,..Repair: good...bad..
11) Vibration: of work place.....of floor.....of building.....
12) Noise: work place.....building.....
13) Posture of operator: stands.....sits.....type of seat (describe).....
14) Respite in work: provided...possible...when taken....state how long...
15) Chart of work place and surroundings attached.

2. Typical Operation:
1) Process chart attached (one or more as needed)
2) Job specification attached

3. Elements of skill operator uses: See rating schedule B, II, 2.

4. Wage: Basis rate.....Bonus on operation.....
Allowance set up.....Total weekly earnings (average of 1 mo.).....
Total earnings 1927.....

5. Hours of work: Average day.....average week.....approximate weeks worked 1927.....
6. Night work: Regular.....occasional.....(maximum) hours night work one week.....

II. TRADE HISTORY OF WORKER

1. Experience this plant:
   1) Length service with plant (years and months).....
   Jobs held and length of time of each.....
   .....
   .....
   2) Special skills developed (general terms).....
   .....
2. Working experience:
   1) Previous major jobs, plant, type of work, length of time held (in years and months).....
   .....
   .....
   .....
   .....
   .....
   2) Reasons for leaving previous jobs (enumerate).....
   .....
   3) Special skills developed (general terms).....
   .....
3. Trade Training, if any:
   1) Type: Apprenticeship.....Upgrade.....Vestibule.....Other.....
   2) Where received.....
   3) When taken.....
   4) How long taken.....
   5) What specialized on.....
   6) Skill developed (general terms).....

III. SOCIAL BACKGROUND

1. Individual:
   Name.....Sex.....Date of birth.....
   Married.....Number of children.....Age of youngest.....
   Age of oldest.....Nativity: self.....
   father.....mother.....Race (W. C. O.).....
   Religion (C. P. J.).....School (public, parochial).....
   Age, grade completed.....Date left.....
   Reason left.....Attitude toward.....
   Other education.....
2. Home:
   Address.....
   House: type.....Number of stories.....
   Rooms.....Families.....
   Individuals.....Condition of repair.....
   Width side yard.....Depth back yard.....
   Condition yard.....Alleys.....
   Street: width.....Condition.....
   Distance from factory.....
   Time required daily.....

3. Leisure Time Activities:
   1) Recreation: Approximate weekly time used.....
   Is operator interested in walking....football....baseball....tennis.....
   golf.....swimming.....hunting....fishing....motoring....basket ball...
   volley ball....pool....bowling....billiards....boxing....wrestling.....
   moving pictures.....theater.....vaudeville.....musical comedy.....
   music.....concerts.....opera.....radio.....gardening.....
   reading: newspapers.....magazines.....books.....
   2) Community activities: Approximate weekly time used.....
   Clubs.....Fraternities.....
   Church.....Union.....
   Politics.....Other.....
   3) Night school: list classes attended, length of time each.....
   .....

B. CHARACTERISTICS OF WORKER

I. CHARACTERISTICS ON PRESENT JOB

1. Habits of Work:
   1) Orderliness:
      a) Arrangement of tools and materials: good.....ave.....poor.....
      b) Personal appearance: neat.....average.....slovenly.....
      c) Care of his tool cabinets, locker, etc.: orderly.....
      average.....disorderly.....
   2) System:
      a) Arrangement of plan of work: good.....average.....poor.....
      b) Steadiness at work during day: poor.....average.....good.....
      c) Regularity of motions on standard job: little.....ave.....great....
   3) Habit of plan?
      a) To make and maintain own program of work, set up: good.....
      average.....poor.....; operation: good.....average.....poor.....
      b) To save motions: good.....ave.....poor..... c) other.....
   4) Regularity:
      a) In attendance: good.....average.....poor.....
      b) In promptness: always.....usually.....has to be checked up.....
      c) In staying at work till closing time: always.....usually.....
      stops work early.....

2. Elements of skill which operator shows:
   1) Technical knowledge:
      a) Of machine principles: good.....average.....poor.....
      mechanical drawing: average.....good.....poor.....
      mathematics: good...ave....poor...; Machine work: poor...ave...
      good....care and operation machine, tools: good....ave.....poor..
      blue print reading: good.....average.....poor.....
      trade theory.....
      b) Of specific machine: operation: good.....ave.....poor.....
      set up: ave.....good....poor....; repair: poor....good....ave.....
      adjustment to new uses: good.....average.....poor.....
      c) Of materials used: strength: good.....average.....poor.....
      speeds: good....ave.....poor....; feeds: poor....good....ave.....
      Use of lubricants: average.....good.....poor.....
      d) Of measuring instruments: micrometer: accurate....inaccurate.....
      caliper: accurate.....inaccurate.....; vernier: accurate.....

inaccurate.....gauge: accurate.....inaccurate.....
scale: accurate.....inaccurate.....
e) Of calculating instrument; slied rule: good.....ave.....poor.....
2) Manual dexterity:
a) Accuaracy of movement: good.....average.....poor.....
b) Speed of movement: poor.....good.....average.....
c) Motion saving: Does naturally.....indifferent.....fails to do....
d) Finger manipulation: dexterous.....average.. ....clumsy.....
3) Sensitivity; Eye: good.....average.....poor.....
b) Ear: good...average...poor... c) touch: good...ave....poor.....
4) Development of automatic reaction:
a) Through rythm: noticeable.....average.....little.....
b) Other.....
5) Personality characteristics:
a) Initiative: considerable.....average.....little.....
b) Responsibility: much.....average.....little.....
c) Judgement: little...ave...above ave...; d) Dependability: good... average...little....; e) Plan: materials: good....ave....poor..... tools: good....ave....poor...; order of work: good...ave...poor...
f) Inventiveness: methods of work: good....ave.....poor....; tools: good.....ave.....poor.....; machine: good.....ave.....poor....
6) Production standing:
a) Is it above average.....average.....below ave.....
b) Give reasons for exceptions from average.....
.....

3. Adjustment to unusual in work:
1) Rush work: high...ave...low....; 2) overtime work: high....ave..... low.... 3) Unfamiliar job: high....ave.....low....; 4) New Processes: high...ave....low....; 5) Delays: high....ave.....low....; 6) Rejected Work: high....ave.....low....; 7) Night work: high....ave.....low..... 8) Other.....

4. Attitude toward work:
1) Regular operation: likes.....indifferent.....dislikes.....
2) Regular set ups: likes.....indifferent.....dislikes.....
3) Variation in either: likes.....indifferent.....dislikes.....
4) Confidence in ability to handle work: high.....average.....low.....
5) Sense of security of employment: high.....average.....low.....
6) Satisfaction in work from: (check apparent sources of satisfaction
a) Job: much...some....none...; b) Wages: much....some...none....
c) Conditions of work:
(1) Physical surroundings: much.....some.....none.....
(2) Social surroundings: much.....some.....none.....
d) Other (specify).....

II. RELATIONS TO INDUSTRIAL ENVIRONMENT
1. To Management:
1) Openness to suggestion: good.....average.....poor.....
2) Acceptance of criticism: good.....average.....poor.....
3) Readiness to coöperate: good.....average.....poor.....
2. To other employees:
1) Sociability: a) Tendency to talk during working hours: great..... average.....small.....

b) Tendency to talk after or between working hours: great.....
average.....small.....
2) Readiness to share work if shortage: great.....ave.....low.....
3) Responsibility for doing his share of work: great....ave.....small.....
4) Adjustment to new associates: easy.....ave.....difficult.....

3. Use of Industrial Facilities: (answer *Y* (yes) or *N* (no))
1) Recreation..... 2) Health.....
3) Lunch room..... 4) Benefit societies, cöoperative and so forth.....

III. FURTHER COMMENT

.....
.....
.....

C. STUDENT'S RATING OF WORKER'S SATISFACTIONS AND DISSATISFACTIONS

If the following are active elements in worker's attitude toward his job, mark *s* if he likes, *d* if dislikes. If not active elements, cross out.

I. SATISFACTION ON JOB

1. Physical: 1) Change of posture..... 2) Activity.....
3) Rythm..... 4) Ease in meeting demands.....
5) Other (name).....

2. Mental:
1) Use of his capacities..... 2) Stimulus to learning.....
3) Stimulus to invention..... 4) No unreasonable demands.....
5) Opportunity for thought.....for sociability.....

3. Emotional:
1) Quantity product..... 2) Quality product.....
3) Beauty of product..... 4) Feeling of ownership.....
5) Competition..... 6) Sense of usefulness.....
7) Exercise of power: over things.....over people.....
8) Sense of prestige: in job.....in product.....in plant.....
9) Other.....

II. SATISFACTION IN WAGES

1. Physical:
1) Ability to meet needs: necessities.....luxuries.....
2) Opportunity for raising standard of living: for self.....
for children.....

2. Mental: Opportunity for "advancement" (not physical) for self.....
for children.....

3. Emotional: 1) Sense of successful rivalry.....
2) Sense of success in relation to social scale.....
3) Other.....

III. SATISFACTIONS IN CONDITIONS OF WORK

1. Physical:
1) Industrial condition in plant: space.....air.....light.....order.....
cleanliness.....health facilities.....safety.....recreational facilities.....
2) General appearance of plant.....

2. Mental:
1) Security of job..... 2) Opportunity for promotion.....

3. Emotional:
   1) Relations with foreman..... 2) Relation with general management..... 3) Relations with fellow employees: sociability..... friendship.....common activities: on job..... off job.....

IV. GENERAL QUESTIONS ON SATISFACTIONS
1. Is present job as satisfying as previous jobs?.....if not, why not?.....
   .....
   Does it use all skills and capacities developed?.....
   Does it leave some undeveloped which individual could name?.....
   Does individual contemplate remaining at it?.....
2. If given choice, what would he do aside from earning more money?.....
   .....
3. Further comment by student.....
   .....
   .....

APPENDIX C

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(To be concluded in the August number)

A Time Questionnaire Study

By Marie G. Andrews, *North Carolina College for Women*

This study of distribution of students' time in a women's college was made in 1925–1926 and in 1927–1928, by a Student Counselor in the North Carolina College for Women at Greensboro.

Over 700 students at the North Carolina College for Women voluntarily kept a record of the use of their time for a week. On a questionnaire they recorded the time they spent in 5 curricular activities, in 12 extra-curricular, in 3 health, in 1 or more remunerative, and in 3 miscellaneous activities. Statistics have been gathered from the data obtained to show the distribution of time spent by the students in these various activities.

A study of the data reveals a constant decrease in the number of hours spent by the freshman, sophomore, junior, and senior classes in curricular activities. The medians for the four classes are: freshmen, 42.7 hours; sophomores, 41; juniors, 39.8; and seniors, 36.1. A study of the data reveals an increase, not absolutely constant, however, from the freshman to the senior class in the number of hours spent in extra-curricular activities. The medians are: freshmen, 26.6 hours; sophomores, 30.1; juniors, 29.5; and seniors, 34.2 hours.

IN THE belief, that, if one can learn the actual use which students make of their time, one can discover the roots of some of the problems which beset a college; and that, if individual students record the actual use which they make of their time for a definite period, they can be helped in the problem of the proper budgeting of time, this time questionnaire study has been made.

The questionnaire used in this study was formulated by a committee of faculty members and students. It was presented to student groups in dormitory house meetings. At this time particular emphasis was laid upon the purpose of the questionnaire, a special point being made of the fact that the purpose was not that faculty members might make a check on the use which any student made of her time, but that there might be revealed to her through this the actual use she was making of it. That the study might be as accurate as possible, only interested students were asked to keep the questionnaire. This plan was used in 1926, and again in 1928 when the study was continued.

The week in 1926 which was chosen for this work proved to be a rather unfortunate time inasmuch as on one day of that week no regular academic activities were held because of the death of one of the charter faculty members. For that reason, in order to make a comparative study of the

THE NORTH CAROLINA COLLEGE FOR WOMEN

TIME QUESTIONNAIRE

Name.....Class.....Dormitory.....Date.....

	NUMBER OF HOURS SPENT							
	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
1. CURRICULAR ACTIVITIES:								
Academic Preparation								
Laboratory								
Class Room								
Conference								
Chapel								
2. EXTRA-CURRICULAR ACTIVITIES:								
Student Government								
Y. W. C. A.								
Class Work								
Societies								
Departmental Clubs								
Dramatics								
Church								
Entertainments and Social Activities								
Unassigned Reading								
Talking and Visiting								
Athletics and other Physical Recreation								
Publications								
3. HEALTH:								
Sleep								
Meals								
Personal Habits								
4. REMUNERATIVE WORK								
5. MISCELLANEOUS WORK:								
Correspondence								
Shopping								
Care of Room								
TOTAL								
Unaccounted for								

FIG. 1. THE TIME QUESTIONNAIRE FORM

two years, the week in 1928 which was chosen had five rather than six class days.

The questionnaire (see figure 1) is divided into five main divisions: curricular activities, extra-curricular activities, health activities, remunerative work, and miscellaneous work. The attempt was made to include in the first group of activities the work required in the academic program. The word, conferences, as used in this division refers only to conferences for work of an academic nature. Since, at the North Carolina College for Women, attendance at chapel is required, a place was provided here for a record of time spent in this activity. The second group, that of extra-curricular activities, consists, for the most part, of student campus activities. That all the subjects in this division may be clear, a word of explanation concerning some is given. For time spent in student government work, a student recorded time spent in such activities as senate meetings, dormitory meetings, dormitory committee meetings, conferences with faculty members for dormitory problems, and conferences with individual girls for student government problems. For time spent in the Y. W. C. A., a student recorded the time spent in Vesper services, in Y. W. C. A. Cabinet meetings, and in all other Y. W. C. A. meetings and activities. At the North Carolina College for Women every student belongs to one of four societies. Inasmuch as these play a considerable part in the social life of the campus, it was deemed advisable to have in this division a special place for a record of time spent in work for them. Time spent in entertainments and social activities including such activities as picture shows, dormitory house parties, college parties, concerts, and teas was recorded. Because a number of hours in every week of a student's life is spent in talking and visiting, a special place was made in the questionnaire for this particular record. The term "athletics and other physical recreation" refers to physical exercise and recreation which is not required, but which forms a part of the extra-curricular program. The third and fourth divisions are self explanatory. Some space was left in the fifth division, termed miscellaneous, for time spent in activities not listed.

There are several points of which one should be mindful in studying data

TABLE 1

Hours spent in four activities

CLASS	CURRICULAR			EXTRA-CURRICULAR			HEALTH			MISCELLANEOUS		
	Q_3	M	Q_1	Q_3	M	Q_1	Q_3	M	Q_1	Q_3	M	Q_1
Freshmen	36.8	42.7	49.4	22.0	26.6	32.9	74.4	78.4	81.9	6.0	8.5	11.2
Sophomores	35.2	41.0	46.4	23.9	30.1	36.5	75.4	79.3	83.9	5.6	8.2	11.6
Juniors	34.8	39.8	44.6	23.8	29.5	36.6	77.6	81.3	85.1	5.5	8.1	11.0
Seniors	30.2	36.1	42.8	26.9	34.2	40.7	69.1	75.8	80.6	6.2	8.7	11.6

Q_3—third quartile; M—median; Q_1—first quartile.

compiled from such a questionnaire. Since the study covered but one week, the figures must not be used to indicate conclusive evidence about the number of students participating in or the amount of time spent in the work of any organization. It is possible that some students may have filled out their questionnaires according to their idea of the use which it was expected that they make of their own time rather than of the actual use which they made. Finally, inaccuracies of a general nature probably occurred in places.

The total number of questionnaires returned in 1926 is 508; in 1928, 225. These are distributed among the classes as follows:

	1926	*1928*	*Total*
Freshmen	212	68	280
Sophomores	120	51	171
Juniors	118	58	176
Seniors	58	48	106

In table 2 a total of 40 hours was used as a standard of comparison for curricular activities. This standard was found by considering 13 hours for class room work (three hours having been deducted from the average 16 because of the probable three scheduled on the day on which there were no classes), two hours for preparation for every unit of work, and two hours for chapel and conferences for academic work.

	hours
Class room	13
Academic preparation	26
Conferences and chapel	2
Total	41

In the distribution of data the classification nearest to 41 was that with the number 40.

In table 2 a total of 72 hours was used as a standard of comparison for health activities. This standard was found by considering 8 hours for sleep for 7 nights, one-half hour for each of three meals for seven days, and one hour a day for seven days for personal habits.

	hours
Sleep	56
Meals	10.5
Personal habits	7
Total	73.5

In the distribution of data the classification nearest to 73.5 was with the number 72.

TABLE 2

Per cents of students who returned questionnaire who spent definite amounts of time in four activities

CLASS	CURRICULAR		EXTRA-CURRICULAR		HEALTH		MISCELLANEOUS
	Less than 40 hours	56 or more hours	Less than 20 hours	36 or more hours	Less than 72 hours	84 or more hours	12 or more hours
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Freshmen	39.5	6.5	16.0	13.5	14.0	14.5	17.5
Sophomores	43.5	5.5	9.5	27.0	11.5	25.5	20.0
Juniors	49.5	3.5	10.5	25.0	3.5	30.5	16.5
Seniors	66.0	3.5	11.0	42.0	30.5	14.0	20.5

An examination of the data reveals that 71 students spent from 0 to 24 hours in work for remuneration, the median being 4.2 hours.

118 students spent from 0 to 15 hours in student government work. The medians for the four classes are: freshmen, 1.5 hours; sophomores, 1.8; juniors, 2.1; seniors, 3.

104 students spent from 0 to 7 hours in Y. W. C. A. work. The medians for the four classes are: freshmen, .9 hours; sophomores, 1.1; juniors, 1.5; seniors, 1.3.

227 students spent from 0 to 8 hours in work for the freshman, sophomore, junior, and senior classes. The medians for the four classes are: freshmen, 1.2 hours; sophomores, 2.1; juniors, 1.5; seniors, .9.

38 students spent from 0 to 38 hours on college publications. The median for this work is 2.3 hours.

124 students spent from 0 to 11 hours in work for departmental clubs. The medians for the four classes are: freshmen, 1 hour; sophomores, 1.8; juniors, 1.7; seniors, 1.7.

561 students spent from 0 to 10 hours in church activities. The medians for the four classes are: freshmen, 2.7 hours; sophomores, 2.4; juniors, 2.7; seniors, 2.5.

510 students spent from 0 to 22 hours in entertainments and social activities. The medians for the four classes are: freshmen, 3.6 hours; sophomores, 4.3; juniors, 4.8; seniors, 4.6.

682 students spent from 0 to 28 hours in unassigned reading. The medians for the four classes are: freshmen, 4.9 hours; sophomores, 5.9; juniors, 5.9; seniors, 6.6.

733 students spent from 0 to 40 hours in talking and visiting. The medians for the four classes are: freshmen, 13.1 hours; sophomores, 11.5; juniors, 10.9; seniors, 11.4.

659 students spent from 0 to 16 hours in non-prescribed athletics and other physical recreation. The medians for the four classes are: freshmen, 3.5 hours; sophomores, 5.1; juniors, 4.3; seniors, 5.1.

The possibilities for studies in a project of this sort are by no means exhausted here. They are limitless. While such a project may have some value in that it is a revelation to the one who examines it of the use which college students make of their time, it is believed that the greater value has come to the individual girls who filled out the questionnaire, and thus had revealed to them the actual use they were making of their time. It is hoped that this questionnaire has assisted them somewhat in the expedient distribution of their day, and that, as a result, time has a new value to them.

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An Aid to the Selection of Pressman Apprentices

By O. Milton Hall, *Personnel Research Federation*

This investigation of the performance of pressman's apprentices in the Minnesota Paper Form Board Test grew out of the studies reported by Dr. Don H. Taylor in the Personnel Journal *for June, 1929. The value of incorporating such a test in a battery of selective aids is shown.*

Ratings of skill of 89 job and cylinder pressman's apprentices are compared with the scores of these men on the Minnesota Paper Form Board test, Series A and B. The reliability of each Series is .90±.01. A definite positive relationship between test scores and judged trade ability is shown. The coefficient of correlation is .58±1.047. Seventy per cent of the inferior workers stand below a critical score set at 45, while only 6 per cent of the workers of average skill, and 5 per cent of those of superior skill fall below that score. It is concluded, therefore, that this test may be used as one tool to aid in the selection of pressman apprentices.

THIS paper is an account of the relationship discovered between success in the Minnesota Paper Form Board test and judged aptitude for the work of pressmen. It reports a small part of preliminary findings in a three year investigation of psychological tests as tools for apprentice selection in the printing industry of New York City. The study, financed coöperatively by the employers, unions and the National Junior Personnel Service, Inc., is being made under the supervision of Don H. Taylor, Assistant Director of the latter organization and Assistant Director of Industrial Relations, New York Employing Printers' Association. Its purpose is to discover objective measures which might be used by the apprentice schools to at least guide away from the various printing trades such young men as are obviously unsuited for the work. During the first year of experimentation, a number of standard group tests were given to apprentices in several branches of the printing trades.

The pressman's work may be best described by quoting a pertinent portion of the preliminary job-analysis:

> The pressman makes ready the press and does the actual job of printimg. He may be assisted in this work by one or more workers called pressman assistants, but is directly responsible for the quality and quantity of the work which comes from the press or presses he has in charge.
>
> In making ready the press he locks the

form containing the composed matter in the proper position on the paper, and makes the many adjustments that are necessary, such as ink supply and distributing mechanisms, automatic feeders, etc. Many of these adjustments are so fine that they are often affected by atmospheric conditions and room temperatures. One of the most important and delicate operations involved in "make-ready" is concerned with making sure that all portions of the job are printing uniformly. This entails careful observation, noting of spots not printing properly and the careful cutting out of paper shapes to be placed under the paper at precisely the points where contact with the form (type, etc.) is not sufficient to bring out detail. The pressman must be constantly alert to detect any variations in the quality of the work. Much work is done with colors.

Pressman and pressman's assistants usually specialize in that type of work produced by one or more of the many special machines that make up the equipment of the modern pressroom. They are known by the type of machine they operate. Thus we have job pressman, cylinder pressmen, web pressmen, etc.

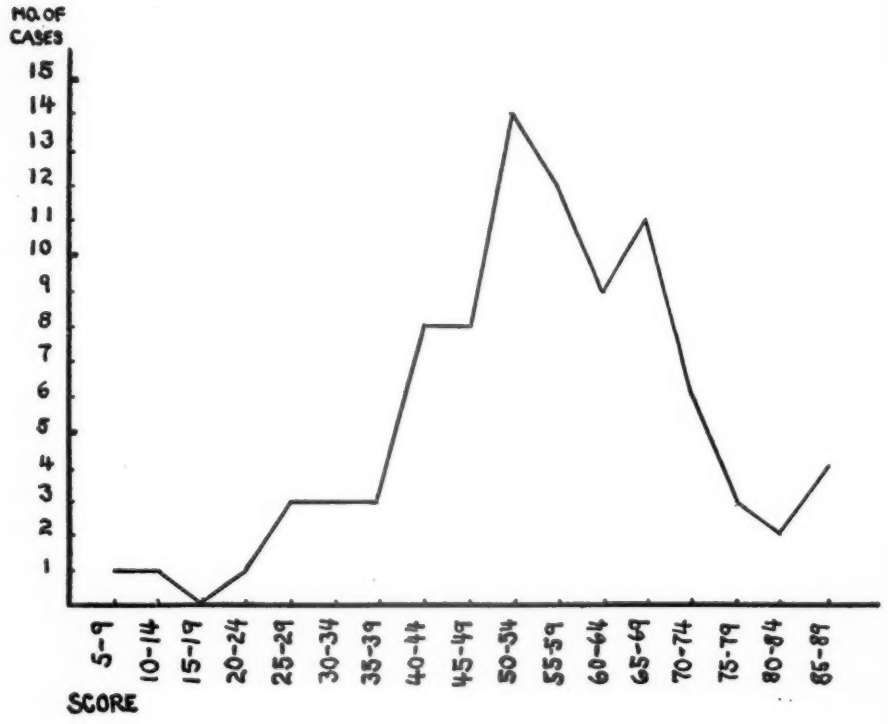

FIG. 1. DISTRIBUTION OF 89 TEST SCORES

The subjects were attending the School for Printing Pressmen, according to union ruling which requires that each apprentice must attend the school six hours per week during the four years of apprenticeship. They were distributed according to Year as follows:

First year	23
Second year	27
Third year	23
Fourth year	16

The average age of the group was thirty years, while the average number of years in the trade was thirteen. Here, then, was a group of mature printers from representative shops throughout the City of New York, brought together in an unusual laboratory situation.

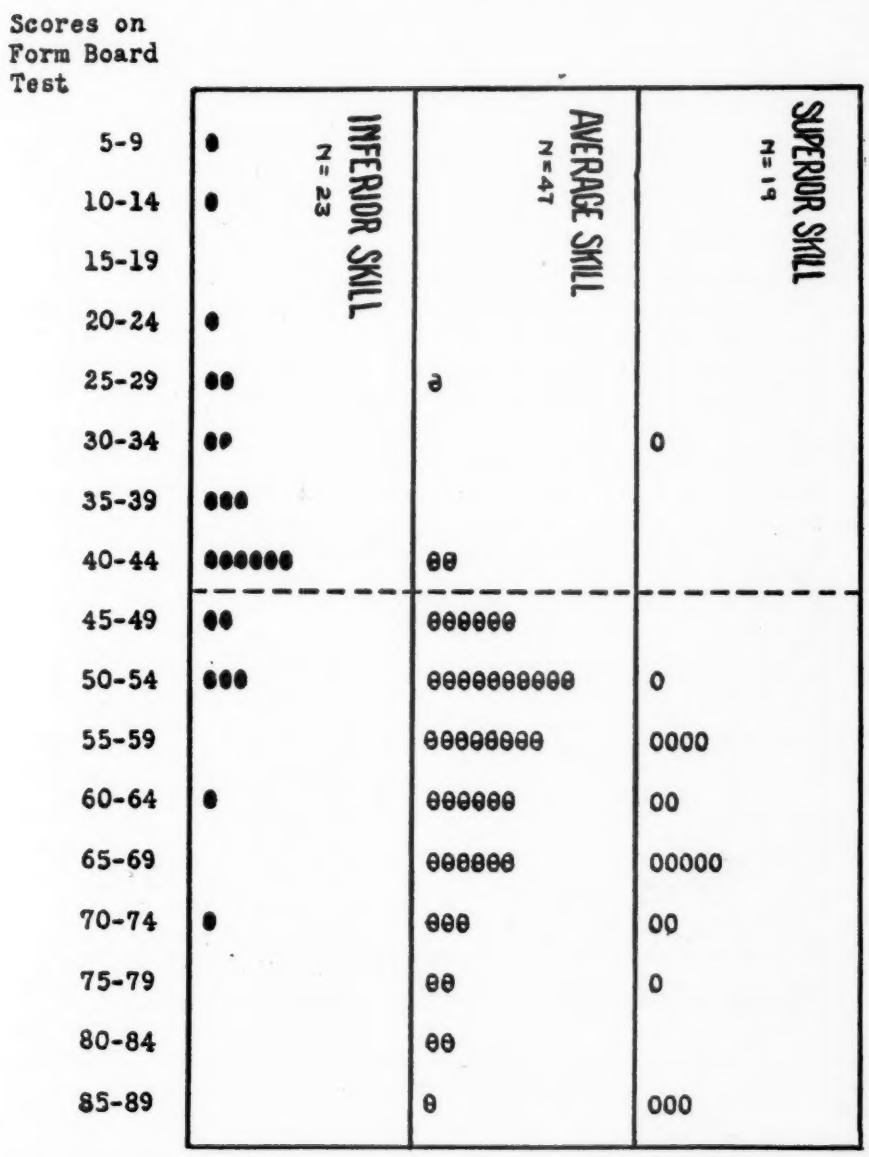

FIG. 2. SHOWING POSITIVE RELATIONSHIP BETWEEN TEST SCORES AND SKILL

Eighty-nine job and cylinder pressmen's apprentices took both the A and B Series of the Minnesota Paper Form Board test. They were tested by Dr. Taylor and the writer during March, 1929, an interval of two weeks separating administration of the two forms. Figure 1 shows the distribution of test scores. As to reliability of the test, the coefficient of correlation between the two Series was .90 ±.01.

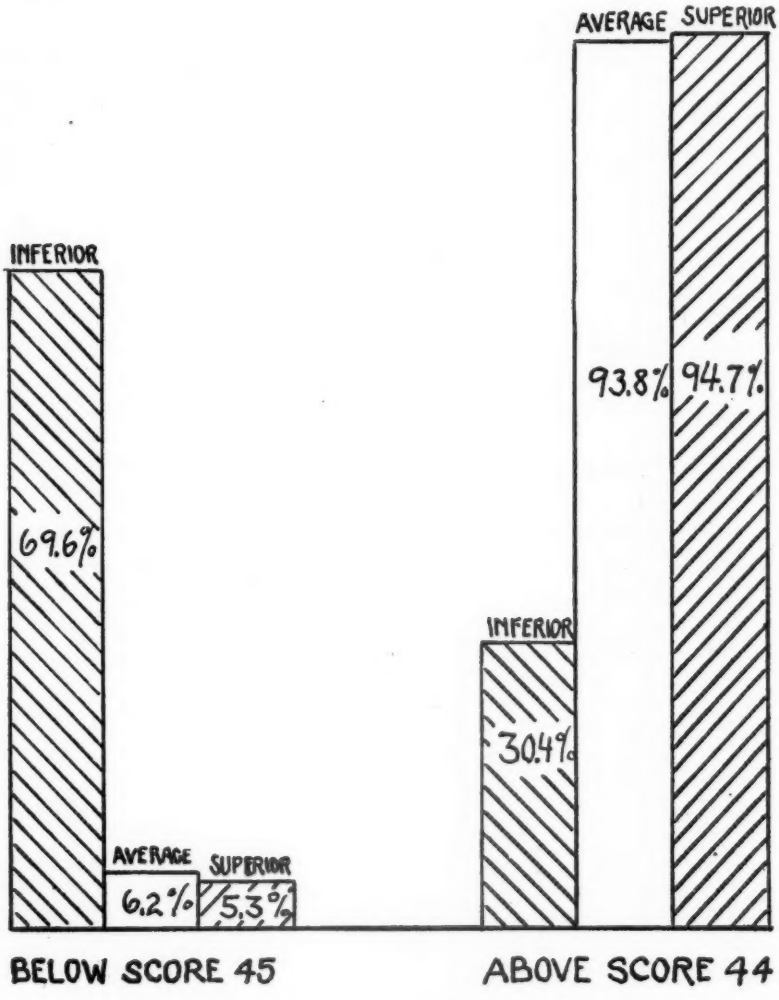

FIG. 3. PERCENTAGES OF GRADES OF CRAFTSMANSHIP FALLING ABOVE AND BELOW CRITICAL SCORE ON TEST

It was of course necessary to obtain some criterion of ability in the trade. Investigations of this sort are usually hampered at this point—and the present one was no exception. Reliance

had to be placed upon ratings of skill by the three instructors. Accordingly a five-point scale was drawn up, ranging from Poor to Exceptional, and ratings on the relative skill of members of the group of *similar experience* were obtained from the instructors. Terms were clearly and concretely defined, and every effort was made to insure maximum reliability. Judgments were of course made independently, but as the instructors worked in close contact there is no way of knowing to what degree they influenced one another's opinions previous to rating.

For statistical purposes numerical values were attached to the five grades and averaged to arrive at the criterion score. No case was used where there was wide divergence on the part of the raters, that is, when one judged a man to be below the average and another above.

The ratings were distributed as follows:

Exceptional	3
Superior	16
Average	47
Fair	21
Poor	2

Correlating this with achievement on the Paper Form Board test, A and B Series, the product-moment method yielded a positive coefficient of .58 with a Probable Error of $\pm$.047.

For graphical analysis the grades of ability or skill are reduced to three: Inferior, Average, and Superior. Figure 2 shows clearly the positive relationship between achievement on the test and judged skill on the job. It is in the form of a scatter-diagram. Along the abscissa are distributed the workers according to the test score, while they are further divided by the three sections into the grades of skill; inferior, average, and superior craftsmen. If a critical score is set at forty-five, 69.6 per cent or 16 of the 23 inferior workers are eliminated, while 93.8 per cent of the average and 94.7 per cent of the superior workers are retained. These percentages are represented graphically in figure 3, where the three grades of craftsmanship are divided into two groups, those falling below the critical score of 45 on the test, and those reaching or exceeding that score. The test is clearly useful as one means of detecting aptitude for the job of printing pressman.

Wide differences between the average scores obtained by the three groups is further evidence of the discriminatory value of this tool. The average scores are:

Inferior Skill group	39.89
Average Skill group	59.31
Superior Skill group	66.45

The Minnesota Paper Form Board test, Series A and B promises to be, therefore, a valuable aid to detecting aptitude for the job of printing pressman. Its use for this purpose at the present time is not advocated; much work is yet to be done in discovering further objective measures to accompany and reinforce this one. But its valuable possibilities are demonstrated.

Manuscript received December 1, 1929

Growth of an Employee Relations Research Study

By G. A. Pennock and M. L. Putnam, *Western Electric Company*

The intimate working relations of employees, supervisors and management can be improved in the common interest as they become better understood. To this end, three articles by Messrs. Pennock, Putnam and Mayo in the February Personnel Journal *have drawn the attention of many executives. The story of how these studies in the Hawthorne Works of the Western Electric Company began and of how they evolved, is told in the following pages. One question led to another, until an effort to determine precise relations between illumination and output had brought the management face to face with highly significant facts about mental attitudes as related to a wide circle of conditions, personal as well as material, outside as well as inside the factory walls.*

IT HAS been characteristic of many quests for knowledge to open up new fields of further experimentation quite different from the original objective. This has been true of the present studies in employee relations being conducted at the Hawthorne Works of the Western Electric Company. The accompanying chart depicts the development of these studies and shows their scope after six years' growth. In the following brief description the figures in parenthesis refer to divisions in the chart.

Beginning in 1924 with a study of illumination (1) to determine the effect of the intensity of light on production (2), the story is one of unexpected findings and an enlarging area of study. Although the illumination study failed to reveal adequate answers to the questions asked, it served to show that studies in human relations could not be conducted by the "single variable technique" that is commonly used in the more exact sciences, and that some method must be used which allows for the simultaneous study of all variables.

These thoughts led to the first by-product (3), which was the realization that all of the factors in the effectiveness of employees should be studied, and that the study should be made by what has been called a "multiple free variable" method. It was therefore decided to establish a test room (4) where as many as possible of the human variables entering into the work situation could be simultaneously observed and where single variables in conditions could be introduced. In the test room were five women oper-

ators engaged in repetitive assembly work. There were also devices for recording their productivity and variation in work. The original objective (5) was to find the answers to six questions, namely:

Do employees actually get tired out?
Are rest pauses desirable?
Is a shorter working day desirable?
What is the attitude of employees toward their work and toward the Company?
What is the effect of changing the type of working equipment?
Why does production fall off in the afternoon?

In conducting the studies certain variables were introduced independently such as altered pay incentive, new supervision, rest periods, lunches, five-day week, and shorter working days. As a check on the effects of these variables, some of the changes were repeated from time to time.

The original list of six questions has grown and at present the objectives are in the form of problems which are called research study projects (6). Each of these projects contains questions for study.

The second by-product (7) arose directly from the conclusions and results of the test room experience. Perhaps the most amazing result was the steady increase in each individual's output ranging from thirty per cent to fifty per cent; the increase continuing regardless of the variable introduced, and accompanied by improved or maintained health, with decreased tardiness, sickness, and absence. After rather definitely evaluating the effect of rest pauses and changes in pay incentive it was concluded:

(a) That the greatest factor in these results was an improved mental attitude of the employees, brought about by better and more personal consideration in supervision, and by freer and more pleasant working conditions.

(b) That the social, home, or outside life, of people is definitely related to their success or failure in their daily work.

These conclusions were based on evidence found in the employees' conversations which had been recorded. Their disclosures showed the need for further study of actual conditions in the regular departments with special emphasis on the employees' attitude toward them.

Thus an interviewing program (8) was established for the purpose of learning the employees' likes and dislikes toward the various elements in their working environment. With this information at hand, it was thought improvements could be instituted which might enable the Company to realize in some measure the results already noted in the test room experiments. At first each of approximately sixteen hundred employees was interviewed and the results were so satisfactory that plans were soon made for extending it to other groups until now it includes about twenty thousand people, all of non-supervisory rank.

Each employee is invited to contribute his comments, and all that he says is held strictly confidential. No identifying information is included in the written report of each interview.

A study of the interviews furnishes data bearing on three fields (9). Comments on working conditions furnish valuable ideas as to possible improvements in the physical working environment and are making desirable

the improvement of many items previously considered satisfactory.

Non-identifying comments of employees are discussed by supervisors in conference groups. Experience with this plan of training indicates that it has advantages not previously obtained by other training means. It gives the supervisor a mirror in which he may see himself as he is seen by employees and yields the values in the employee's point of view without the fruitless hard feelings which result from the method of direct accusation and argument. Approximately two thousand supervisors are now meeting bi-weekly to discuss employees' comments.

A combination of the comments of employees and the supervisory discussions are furnishing a new and valuable check of Company policies affecting employee relations.

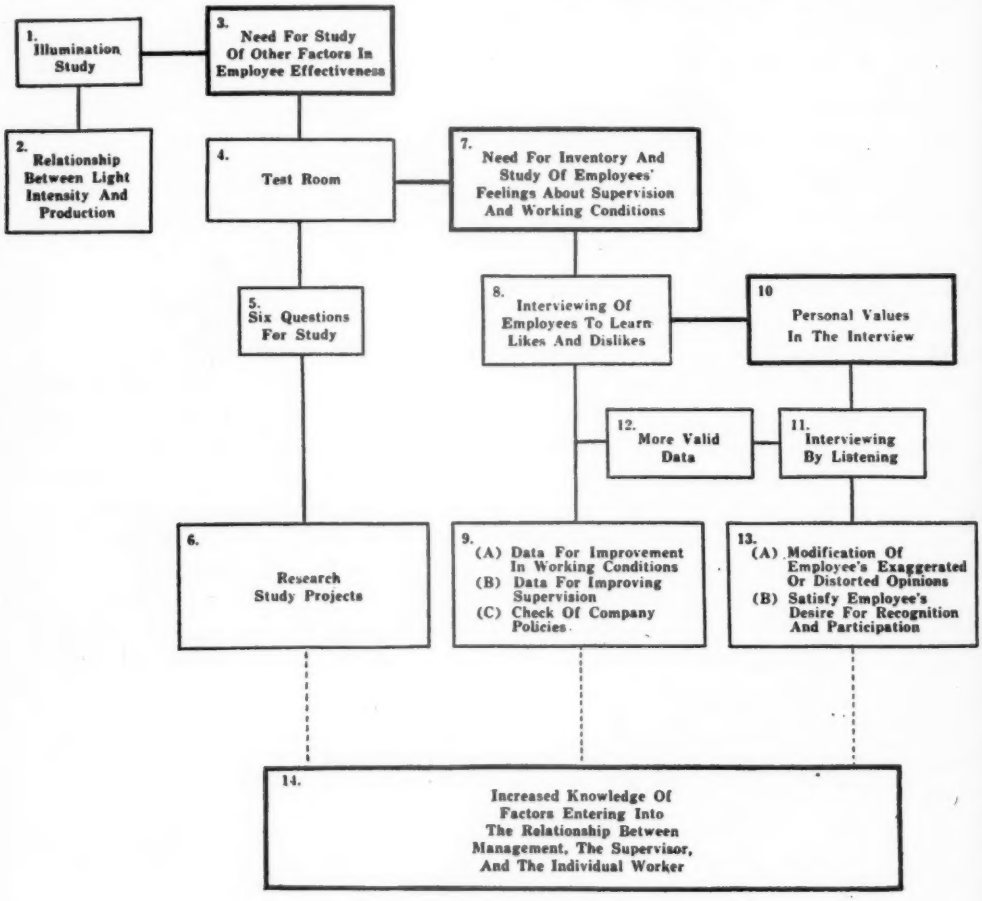
1. Illumination Study
3. Need For Study Of Other Factors In Employee Effectiveness
2. Relationship Between Light Intensity And Production
4. Test Room
7. Need For Inventory And Study Of Employees' Feelings About Supervision And Working Conditions
5. Six Questions For Study
8. Interviewing Of Employees To Learn Likes And Dislikes
10 Personal Values In The Interview
12. More Valid Data
11. Interviewing By Listening
6. Research Study Projects
9. (A) Data For Improvement In Working Conditions (B) Data For Improving Supervision (C) Check Of Company Policies
13. (A) Modification Of Employee's Exaggerated Or Distorted Opinions (B) Satisfy Employee's Desire For Recognition And Participation
14. Increased Knowledge Of Factors Entering Into The Relationship Between Management, The Supervisor, And The Individual Worker

FIG. 1

The third by-product (10) is perhaps the most outstanding of all. It may be called the realization that the interviews, in providing a channel of

expression for employees without fear of consequences, benefit the employees themselves. It has led to an entirely new conception of the program and has been the basis for the development of the present method of interviewing which is a radical departure from methods previously used. As evidence of this beneficial effect, many comments have been received from employees which in substance are as follows: "Gee, I sure do feel better now that I have that off my chest."

With this knowledge it became clear that if a channel for free expression were to be provided, the interview must be a listening rather than a questioning process (11). The interview is now defined as a conversation in which the employee is encouraged to express himself freely upon any topic of his own choosing. No restrictions as to time or subjects are made. Employees are paid average earnings for the time consumed in the interview.

It is interesting to note that with the development of this type of interview, it became evident that the information gained was more valid than when the interviewers had suggested topics upon which the employees should express themselves (12). It seemed a fair assumption that a spontaneous comment, arising without suggestion, was of more importance to the employee than one which followed a direct question from the interviewer.

These personal values are growing in importance as the program develops. It has been found that employees' opinions, in many instances, tend to become exaggerated and distorted probably because of continued thought on unpleasant subjects, and that these distortions become modified when freely expressed to a sympathetic and critical listener. Another element in this type of interview is that employees appreciate being recognized as individuals who have valuable comments to make, and enjoy the opportunity to offer their thoughts (13).

While the above brief view of the studies being conducted may seem to indicate that they are widely varied, they all have the same objective (14); namely, to increase the knowledge of factors entering into the complex human relationships found in the industrial order of to-day.

Manuscript received April 3, 1930

The German Industrial Inquiry

Some Findings with Reference to the Psychology of Labor[1]

By Otto Lipmann, *Berlin*

TRANSLATED BY MORRIS S. VITELES

The distinguished industrial psychologist, Dr. Otto Lipmann, has for three years co-directed the investigations of the Efficiency Committee of the German Industrial Inquiry Board. Readers of the Personnel Journal will recall his thoughtful paper on The Human Factor in Production, published in August, 1928.

The nature of the problems studied by the Industrial Inquiry Board is indicated, and findings with reference to two of the major problems are discussed by way of illustration. The reaction of the worker toward the introduction of machinery is found to be hostile, because work in the mechanized plants involves considerably more bodily strain and increased mental strain. Unwillingness to break fixed habits is a factor. The machine deprives workers of jobs. They do not fully profit from the increased production brought about by machines. The use of machinery in plant operation brings certain definite benefits to the workers, but these are not acknowledged as such by reason of his violent objections, at least at the beginning. The other major problem concerns changes in sickness and accident figures. Various obvious and subtle factors affecting the number of sickness and accident reports are presented and analyzed.

TWO techniques have been employed by the Efficiency Committee of the German Industrial Inquiry Board in seeking an answer to the question of the relationships between production and working hours and between production and wages. The first involves an analysis of plant statistics; the second, a direct interview of plant owners, plant managers and workers. It follows that the findings are of two kinds, consisting in part of a large mass of statistical data and in part of conclusions growing out of the interviews. To some degree, of course, the findings are in the form of a combination of these two kinds of data, and that combination is the most important method, because purely statistical results have no value, if they are not supplemented by the report of persons who are working on the job; and such purely sta-

[1] Paper read before the Ninth International Congress of Psychology, New Haven, Conn., September 6, 1929.

tistical results can lead to absolutely wrong conclusions. The Committee has therefore given special attention to the method of interview and has published some of its interviews verbatim.

The investigating procedure employed in this work is a new and fruitful one. It has never yet been possible to gather such a wealth of statistical material concerning industrial plants, and to make comparisons among plants on so large a scale—a wealth of material which, however, is oriented not solely from the viewpoint of what appears to be of particular interest to one or another *plant*, but reflects in its organization the point of view of the *investigator*. Such data, the preparation of which involves a tremendous amount of work, can only be assembled by an investigator endowed with broad statutory privileges and to whom the plant under investigation is obliged by law to supply information.

At the same time the character of the investigating committee, made up of men of learning, of representatives of the various political parties and trade groups, naturally aided by those with expert knowledge of the industry under investigation, is a guarantee of the objectivity and impartiality of the data obtained in the course of the investigation.

The investigation was oriented not primarily as a psychological study, but as more broadly concerned with the science of labor. But inasmuch as in general, psychology plays a rôle alongside of physiology, hygiene, techniques of various sorts, trade education, etc. in the science of labor, the findings may be described as not without value to industrial psychology.

Before presenting such results from this study as can be given in the time allowed, it may be well to indicate briefly the nature of the problems which came up for consideration. What is the effect upon the mental attitude of the worker, more particularly upon his will to work, of various wage systems; of various wage levels, in relation to the purchasing value of money; of payments in money or in kind? What is the reaction to deductions from his pay for insurance or other purposes? How does he react toward the introduction of machinery, toward scientific management, and towards the effects of these upon the labor market and the relationship between labor and production costs? What is the relationship between the intensity of the will to work and the frame of mind of the worker on one side and production in general, the relationship to the working organization and the attitude or disposition of the worker toward the plant and toward production on the other side? What are the effects of working conditions in one industry or trade, as compared with another related industry, upon the stability of the worker? In what way, for example, is the tendency to leave the country, to leave farm work, favored or counteracted by working conditions in industry as compared with working conditions on the farm? What is the effect of unemployment insurance upon the willingness or desire to work? How does the amount of sick benefits, in relation to pay, influence the tendency of the worker to report sick? Upon what

sort of circumstances depend the number of sickness and accident reports on the one hand, the number of accidents calling for compensation on the other hand, and the relationship between the two? Is the frequency of sickness and accidents a measure of the worker's efficiency? How do the aptitude and fatiguability of the worker influence his production? What is the influence of working and living conditions upon the way in which the worker spends his free time, and how does this, at times, reflect itself in production?

I can only refer briefly to the findings of the committee concerning a few of these problems. It may be well, however, to point out at once what appears to me to be the most significant of these findings. In no instance is it possible to conclude that any one of the working conditions which have been under investigation is to be singled out as "favorable" or "unfavorable" from the point of view of the frame of mind of the worker. The object of psychological investigation in industry must be that of determining under which *related* conditions the worker reacts in one or another manner to a wage system, to a threat of discharge, to payments in kind, etc. These related conditions are found, on the one hand, in co-incident external conditions and their particular configurations; on the other hand in the person of the worker.

I shall now consider briefly the findings with reference to one or two of the problems referred to above.

The first of these is the reaction of the worker toward the introduction of machinery.

OBJECTIONS TO MACHINERY

The period since 1913 has been marked by a tremendous increase in the use of machinery in the anthracite coal mines of Germany. Whereas in 1913, 95 per cent of the coal was mined by hand, through blasting, in 1926 the percentage of hand mined coal had been reduced to 33 per cent. Anthracite coal mining is a particularly suitable and interesting field for investigating the worker's attitude toward such mechanization. The report of the Efficiency Committee has the following to say in this connection.

In mining, the newly introduced machinery has been objected to with great feeling by the workers, at least the older workers, mostly on the ground that work in the mechanized plants involves considerably more *bodily* strain and also increased *mental* strain resulting from the noise and the greater claims upon attention.

However, it was found that this violent objection on the part of workers to machines did not lead them to give up using the machines when they had the choice of using the pick axe. As a matter of fact, it was often noticed that the workers thronged to the plants using the machines, and even objected when an attempt was made to deprive them of compressed air hammers. However, such facts must not be interpreted as meaning that the workers' objection was only "talk," and actually did not exist. For such a conclusion the reports of the workers are too general. There certainly remains a need for investigating the motives, in the mind of the worker, which lead to overcompensation for this violent objection.

One of the most important facts, which should be given first consideration, is the conservatism of the miner. It is by reason of this that the antagonism of the older pick man, who has not yet accustomed himself to the compressed air hammer, was greater than that of the younger man who had not worked long with the hand drill. So long as the worker is not familiar with the new working method he objects to it. He does not willingly work with the conveyor, but once he starts working with it he does not willingly leave it. One reason for this conservatism is the worker's unwillingness to be deprived of companionship.

Of further importance in the miner's, particularly the older miner's, steadfast opposition is the fact that the machine deprives workers of jobs. The worker receives no benefits from the introduction of machines, because he does not fully profit from the increased production resulting therefrom. It is true that the workers seek employment, perhaps even unwillingly, in the plants in which machines are used, because they can earn more in such plants than in others, but they feel that the increased pay does not correspond with the increased expenditure of effort and to the increase in production.

One possible reason for the worker's preference for plants in which conveyors are used, in spite of their objection of mechanization, is the superiority of the air supply in such plants.

Furthermore, certain of the workers do not show a preference for the mechanized plants by reason of its machines, but by reason of a preference for the organization in the mechanized plant in comparison with the non-mechanized plant. The control in the non-mechanized plants is stricter. From every man a set quantity of coal is required, and the work is also more difficult because very close attention and considerable knowledge are required on the part of every man. In the mechanized plants, on the other hand, all that is required are regular work and a little knack which any worker can readily acquire.

In other instances the worker's objection to the plant with conveyors is based on the requirement in such plants that the worker perform a set task, whereas in the other plants, apart from the usual control, the worker feels fairly free at his work. So it is possible, in contradiction to what has been said before, that opposition to plants using machines may also reflect an opposition to the stricter organization in such plants.

In a certain sense the use of machinery in plant operation makes it easier for the worker at certain points. The introduction of the compressed air hammer has decreased the amount of blasting and the amount of fumes and danger associated with blasting. The use of the conveyor, as compared with the use of the coal shovel, decreased the amount of coal dust. The cutting machine makes it unnecessary for the worker to bore lying on his back. However, these benefits are not acknowledged as such by reason of the workers' violent objection to machines, at least at the beginning.

SICKNESS AND ACCIDENT FIGURES

Among the reasons for changes in sickness and accident figures the report distinguishes the following:

1. Changes in *health status* occasioned by:
   a. Epidemic diseases
   b. Changes in nutrition habits
   c. Changes in living conditions
   d. Changes in number of tasks to be done and the number of hours in the working day
   e. Changes in the rate of work
   f. Changes in technical training
   g. Changes in the status of safety work
   h. Changes in the classes of labor
2. Changes in the *incidence* of illnesses and accidents occasioned by:
   a. The economic status of the worker and the level of sickness payment
   b. The employment and control exercised over the Medical Office physicians

Following are a few comments on this topic from the report. At the time when the plant made less demand upon the man in the way of rate of work, a worker with a minor illness or injury could still meet the production requirements. However, although his condition remains the same, when greater demands in the way of intensity of work are made, he must report sick. During the inflation period, in general, work was pursued less actively, and the worker could still produce the required amount, even when suffering from minor illnesses.

Furthermore, if the wage rate is too low, a worker, anxious to earn a given amount, may be led to neglect paying sufficient attention to safety and underpinning, as a result of which there may be an increase in accidents caused by falling stones and coal.

When a mine is forced to employ a great number of new workers, satisfactory standards of employment can not be adhered to. Men are hired who are generally not the most satisfactory and an increased accident and illness rate may ensue, as has been the case in certain of the plants.

Newly employed workers have about three times as many accidents, and twice as many cases of sickness as older employees. On the other hand, the duration of illness is longer and the effects of accident are more marked in the case of employees with the greater length of service.

The number of accidents and cases of illness as well as the number of days taken from work as a result of these, increases in direct proportion to the distance of the workers home from the mine shaft. This appears particularly in the case of newly employed workers.

During the inflation period of 1919 to 1923 the difference between the amount of wages and that of the sick benefit payment was very large, especially since health benefits were payed less frequently, that is, in fewer instalments than wages, so that at the time of payment the purchasing value of the health benefit had become considerably decreased. This resulted in marked hesitation in taking time off by reason of illness. Even those workers who were not quite well remained at work in preference to reporting sick. Because of this, during the inflation era, the figures for illnesses were low in spite of malnutrition.

The revision of the labor laws, which were put into effect in July 1926, brought closer payments during long illnesses, particularly in the case of married men with children. The higher

percentage of heads of families staying out by reason of illness, as compared with the figures for the plant as a whole, comes, in part, from the fact that the incentive toward taking time off because of illness increases in strength and the resistance against it decreases, as the difference between the amount of sick-benefits and wages decreases. However, it must be kept in mind that there is a higher percentage of older men among the married men, and that with age alone the incidence of time off by reason of illness increases. Moreover, thought must be given to the fact that although proportionally the loss in wages is less for the married man than for the single man, in the case of the former every loss, however small, is of great significance.

The argument that the amount of sick benefit and the difference between sick benefits and wages cannot influence the health figures, because the doctor passes upon illnesses, is not altogether tenable, inasmuch as the decision whether one who is not feeling quite well, should report sick, is determined on the one hand by the results of continuing at work, and, on the other hand, by the effects upon the worker and his family. If the difference between wage and sickness benefits is small, the worker considers reporting to the doctor in the case of even minor illnesses; if the decrease is large and difficult to bear, the worker drags himself to work even though he is seriously ill.

Other comments on illness and accidents can be cited. Perhaps the best illustration of what has already been said concerning the dependence upon circumstance of the worker's reaction to similar situations is to be found in his attitude toward a proposed reduction of force in the plant. The danger of losing his job may lead either to an increase or to a decrease in production. It leads to a decrease when there is an absence of urging, on the part of the plant management, due to the absence of a market for the product. In this case the worker tries to "stretch the work" and thereby to postpone discharge as long as possible. Increased production results, if the worker believes that the least efficient workers are to be discharged first and the most efficient to be retained longest. No example shows as well as this the complexity of the situation, the fact that it requires concrete study on the spot and personal contact with plant managers and workers, and that nothing can be accomplished by an arm-chair analysis of the situation.

I hope that I have been able to give an indication of the broad scope of the committees-investigation and at the same time to demonstrate that the procedure employed in its inquiry is of value from the viewpoint of the psychology of work. I have been particularly interested in pointing out the close relationship between such problems in the psychology of work and the broader field of the science of labor. On the one hand the psychologist interested in work must not cease to be a psychologist, yet, on the other hand, the psychological problems can only be resolved when considered in their relation to other factors in the field of the science of labor. It is this close relationship which has led me in this report to overstep the bounds of psychology in its narrower sense.

Manuscript received September 8, 1929

News Notes

PERSONNEL RESEARCH FEDERATION

Activities of Member Organizations

University of Pennsylvania Department of Industrial Research

The following report of the Department of Industrial Research, University of Pennsylvania, is sent by the Director, Joseph H. Willits.

Established at the Wharton School of Finance and Commerce early in 1921, the purpose of this department is to "apply the methods of thorough scientific research to various fundamental problems in industry, such as industrial relations, so that human well-being, and especially the more general distribution of human well-being, may be increased, and to provide a bureau to which the various elements of the industrial community may turn for scientific research on industrial problems."

The research has been and is on co-operative lines, the first undertaken being a study of monthly labor turnover in 25 plants in diverse industries in Philadelphia. The reporting was continued through 1928 and led to the publication of "Labor Mobility" and "Four Years of Labor Mobility." Work by members of the staff with the United States Coal Commission, 1923, resulted in the publication of "Earnings of Coal Miners," "Conclusions and Recommendations of the United States Coal Commission as to Labor Relations in Bituminous Mining," and several chapters in "What the Coal Commission Found." "The Trend of Wage Earners' Savings" was the result of a study of savings institutions and methods in Philadelphia over a considerable period.

Co-operation with the Metal Manufacturers' Association of Philadelphia gave the department information on labor turnover, factory lunch rooms, accidents and accident prevention methods, and earnings of metal workers. Mimeographed reports on these subjects have been issued to the co-operating companies.

The original material for the study entitled "Earnings and Working Opportunity in the Upholstery Weavers' Trade," came from the members of a local union in the form of weekly reports of earnings and hours over a two-year period. "Collective Bargaining in the Photo-Engraving Industry" came from employers and union officials in the industry as well as a survey of the literature.

Monthly records of production and shipments of 49 iron and steel foundries, originally sent to the Philadelphia Federal Reserve Bank, supply material for a monthly report as well as for the study "Trends in Foundry Production." The results of a survey of the production of knitting machinery and of full-fashioned hosiery are contained in "Significant Post-War Changes in the Full-Fashioned Hosiery Industry."

Further research in the field is now being conducted on the subject of output of hosiery manufacturers and earnings and working time of a group of workers in the industry. The co-operation of the employers and of the union is making the respective studies possible.

"Earnings in Certain Standard Machine-Tool Occupations" is a further development of the material supplied by the metal manufacturing plants, with the addition of some intensive data in a smaller group of plants.

Data from woolen and worsted spinners is incorporated in the "Analysis of Production of Worsted Sales Yarn."

The analysis of "Help-wanted Advertising as an Indicator of the Demand for Labor" makes use of the classified advertising in daily newspapers with considerable attention to the various occupations and industries specified in the advertisements.

Further studies now in progress concern

the unemployment situation in Philadelphia, the use of the group-bonus as an incentive, the effect of mechanization on workmen, an index of wage rates in the bituminous coal fields, and a study of earnings and selling costs of salesclerks in a representative group of department stores.

Western Electric Company

The latest Report to Stockholders of the Western Electric Company reveals that there was an increase of 50 per cent in the number of employees during the year, from 56,324 at January 1st to 84,848 at December 31st. As was expected the increase was greatest in the Manufacturing and Installation Departments, where the rapidity of the increase threw a heavy burden upon the supervisory forces in planning the work and instructing new employees.

The Company has been active for many years in the movement to prevent industrial accidents by not only making machines and processes safe, but also in training its employees in habits of safety. The results of this educational campaign are indicated by the fact that notwithstanding the large number of new employees, the relative number of accidents has been steadily decreasing, and now stands close to the lowest point in the history of the Company. Continued efforts have also been made, with satisfactory results, through the conduct of health courses, to instill in the minds of employees proper regard for their physical condition.

Opportunities offered to the Company's employees for self-improvement through study outside business hours have continued in popularity. During the year there were more than 10,000 employees enrolled in more than 300 evening classes held each week.

Deductions from salaries and wages authorized by employees for thrift purposes amounted to $11,774,000 or 8.9 per cent of the total payroll, amounting to upwards of $132,000,000. This compares with 9.8 per cent in 1928, the decrease being largely due to the number of employees who have been with the Company too short a period to take full advantage of these opportunities.

University of Chicago Board of Vocational Guidance and Placement

Frederic Woodward, Acting President of the University of Chicago, 1928–1929, in his General Statement reports the following:

"Organized in the previous year with the purpose of consolidating the activities of the old Board of Recommendations and the Employment Bureau, the Board of Vocational Guidance and Placement has undertaken the systematic development of business and industrial placement of students at graduation. A promising beginning was made in this new field, and there was a marked increase in the use of the service in the old fields of teacher placement and part-time student employment. Mr. W. H. Cowley, the Executive Secretary of the Board, resigned at the close of the year, and we were fortunate enough to secure as his successor, Mr. Robert C. Woellner, formerly Principal of the University High School."

GRAPHIC ARTS EDUCATIONAL CENTER

A formal request to the Board of Education for a $2,500,000, building to serve as an educational center for the Graphic Arts Industry was included in a statement issued by a conference on printing education in New York City. The conference which was attended by representatives from all the employer and craftsmen's organizations in the industry, announced the formation of a committee, headed by Peter J. Brady, President of the Federation Bank and former President of the N. Y. State Allied Printing Trades Council, to take charge of a campaign to obtain favorable action on the request. Isaac H. Blanchard, Chairman of Board, Blanchard Press, presided.

The statement issued by the conference follows:

We, the representatives of the employer, union, and allied industries, organizations of the Graphic Arts Industry of New York City, members of a conference on printing education held in New York City on January 30, 1930, desire to record our convictions as to the need for more adequate training facilities for the Graphic Arts Industries of the City of New York.

Printing and its allied trades constitute one of the few industries still dependent upon high standards of individual craftsmanship. In no other major industry does the skill of the individual employee play a larger part and no other industry offers better organized and accepted principles and practices as the content and basis of trade training. Continuance of New York City's national and international supremacy in the trade requires the establishment and maintenance of training opportunities and facilities which will adequately supplement job experience.

Vocational educators are agreed that effective trade and apprentice education comes only through a program of training on the job supplemented by properly related school experiences. There is also general acceptance of the fundamental principle that the public should bear part of the cost of vocational education, particularly when the industry in question touches the vocational lives of so many members of the community as does the Graphic Arts Industry.

The organizations in the Graphic Arts Industry here represented have already shown their appreciation of the need for, and their interest in the educational problems of the industry by co-operating in the maintenance and operation of seven apprentice and pre-apprentice schools, now enrolling more than 3,000 students. Present facilities, however, are seriously inadequate and many technical branches of the industry have no special training facilities of any kind.

Adequate training of craftsmen for the industry can be provided only through the erection of a specially designed central building, serving the entire city and all branches of industry. This fact was recognized as far back as 1918 when an industrial education survey commission of the Board of Education of the City of New York pointed out the urgent and essential need for an educational center for the industry and unanimously recommended the erection of a Graphic Arts Building. The reasons found then for centralizing all educational activities for the graphic arts have become more urgent with the passing of time. At a cost of less than one technical high school New York can adequately serve the educational needs of its second largest industry which employs nearly 70,000 craftsmen, includes more than 3000 firms and produces nearly one-fourth of the printing of the United States and one-twelfth of that of the world.

In accordance with these convictions we join together in urging the Board of Education to include in its 1930 budget an item of $2,500,000 to provide for the erection of an educational center for the Graphic Arts Industry.

We recommend, also, that the members of this conference urge their respective organizations to pass resolutions favoring this project.

Finally, we recommend the appointment of eight members of the conference to serve as a steering committee in charge of a program of activity which will effectively bring before the Board of Education the essential need for, and significance of, this proposal.

THEOLOGICAL EDUCATION TO BE SURVEYED

A three-year study has been started to discover the true condition of theological education in this country. It is being made by the Conference of Theological Seminaries and the Institute of Social and Religious Research. Professor Mark A. May of the Department of Psychology of Yale University is director of the study, while Dr. William Adams Brown of Union Theological Seminary is theological consultant. Among the members of the executive committee are:

Dr. Douglas Mackenzie, president of Hartford Seminary.

Dr. Lutheran Allan Weigle of Yale Divinity School.

Dr. George Warren Richards, president of the Theological Seminary of the Reformed Church in the United States at Lancaster, Pa.

Dr. Ezra Squier Tipple, until recently president of Drew Theological Seminary.

Dr. Shailer Mathews, dean of the Divinity School of the University of Chicago.

Dr. Kirsopp Lake, Winn Professor of Ecclesiastics, Harvard University.

Dr. Charles M. Jacobs, president of Lu-

theran Theological Seminary at Mount Airy, Philadelphia.

Dr. J. Ross Stevenson, president of the Princeton Theological Seminary.

Dr. Hughell Edgar W. Fosbroke, dean of General Theological Seminary, New York.

WESLEYAN UNIVERSITY STUDENT SURVEY

What has been called by authorities the most comprehensive survey of student life and opinion in a college ever projected by the students themselves is being successfully accomplished at Wesleyan University. A 16-page questionnaire prepared by an undergraduate committee, probing the individual's campus life and his reactions to many phases of college, has been answered by over 95 per cent of the student body, a record percentage which will give the findings great practical value when added to data which the University now possesses.

The survey covers the subjects of fraternities, faculty-student relations, athletics, reasons and purposes for coming to college, the curriculum, vocational guidance, and social life.

When analysed, it is expected that the findings will enable the college administration to meet the needs of the student body more faithfully, in matters of curriculum, discipline, and vocational guidance.

UNIVERSITY OF TORONTO

An interesting comment has been received from Professor E. A. Bott of the University of Toronto in regard to the Western Electric Company's industrial relations investigations reported in the February number of the PERSONNEL JOURNAL. It says in part, "Putnam's findings and methods in modifying the basic attitudes of employees and supervisors by means of individual interviews and training conferences for supervisors seem to me to be most significant. I am particularly struck by the fact that in all essentials this plan and its results so closely parallel the procedures we have developed during the past five years at the St. George's School for Child Study in the field of Parent Education. Except that (1) the group discussion method is primarily used in Parent Education with the individual interview as secondary, and (2) that the content pertains to the child-parent relationship rather than the employee-job-supervisor relationship, the situations and procedures are very alike. The method of training parent group leaders by conferences upon the raw data recorded from group discussions corresponds to Putnam's training for supervisors—the objective being the control of attitudes in both cases."

INDUSTRY REPORT

Industry Report is a monthly periodical covering industry, particularly as the human element is involved. It does not attempt a superficial, plausible account of many industries, but goes thoroughly into one each month. A simple explanation of the manufacturing process, illustrations depicting processes, and a job analysis are regular features. Hazards pertaining to the work are analyzed by Dr. Carey P. McCord, an industrial health expert of note and corporate representative of the Industrial Health Conservancy Laboratories to the Personnel Research Federation. The March report is devoted to Composition Roofing, while two subsequent reports deal with Nitrogen Fixation (Synthetic Ammonia), and Copper (Mining, Refining, etc.). Industry Report is published by the Retail Credit Company of Atlanta, Georgia, and costs $12 annually.

JOURNAL OF HIGHER EDUCATION

The Journal of Higher Education has been founded to serve as the professional journal of the sixty-seven thousand instructors and administrative officers in the colleges, universities, and professional schools of the United States. The editors plan to bring to their constituency reports of the most significant investigations in the instructional, administrative, personnel, and curricular problems in all branches of higher education. The list of associate editors includes representatives from every department of academic responsibility in higher education, and these, co-operating with the editor, will attempt ten times a year to report upon the progress of higher education. The magazine is edited by W. W.

Charters and published by the Ohio State University Press.

SUMMER SCHOOLS

The Summer School of New York University in coöperation with the National Junior Personnel Service announces a series of courses on Vocational Guidance, Counseling and Personnel Service. Registration begins July 3, while the regular Summer Session will extend from July 7 to August 15. The courses being offered are "Personnel Administration," "Counseling Methods," "Vocational Information, Guidance and Placement," all by Professor Anna Y. Reed, and "Course for Deans and Advisers of Men and Women," by Dr. Leonard.

Harvard University offers several courses in Vocational Guidance:

The Principles and Practice of Vocational Guidance, Occupational Information, and Labor Problems, by Dr. Franklin J. Keller.

Counseling and the Administration of Vocational Guidance, by Dr. Richard D. Allen.

Psychology and Vocational Adjustment, and Testing Vocational Aptitudes, by Professor Clark Hull.

Education as Guidance, by Professor John Brewer.

Seminary in Problems of Educational and Vocational Guidance, by Dr. Allen and Professor Brewer.

MECHANICAL ABILITY TESTS

"Tests of Mechanical Ability" by F. M. Earle and A. Macrae is the title of Report No. 3 of the National Institute of Industrial Psychology, London.

'Mechanical ability' is defined as the ability to grasp and to employ the mechanical principles involved in the use of machines and implements. To devise a vocational test which will disclose and estimate this ability satisfactorily, and to examine the psychological and other factors entering into and affecting such a test, were the essential objects of this investigation.

The tests described and studied all consist in putting together the parts of simple mechanisms. In its final form the test has been standardized, after being applied to over 600 adolescents and young adults individually.

The investigations show that success in this test is influenced (1) by the ability to perceive relations of shape or form and, to a less extent, (2) by general intelligence and (3) by manual dexterity. Although the test here studied is of useful prognostic value for youths up to the age of 15 or 16 who have not yet received any specialized training, the conclusion is reached that for older boys about to enter particular trades additional tests will need to be employed.

SELECTION BY PHOTOGRAPH

A study on the Value of the Photograph in the Selection of Teachers by W. B. Johns and D. A. Worcester was reported in the February number of the Journal of Applied Psychology. The general conclusion to which the study leads is that there is little if any value in a photograph as a means of furnishing information about ability to teach, at least as now used by superintendents, secretaries of school boards, and secretaries of placement bureaus. No individual was found who possessed any particular talent for judging teaching ability from photographs. Individuals disagree markedly when they attempt to pick out and name the apparent elements of character in a face as shown by a photograph.

PERSONAL ITEM

Dr. C. S. Yoakum, Dean of the College of Liberal Arts at Northwestern University, returns at the end of the present academic year to the University of Michigan, where he will be Vice President and Director of Educational Investigations.

Personnel Books

EDITED BY DOUGLAS FRYER

The critical reviews published in this issue indicate the breadth and variety of personnel activities. Professor Burtt's book surveys the accumulated research of recent years upon the adjustment of the worker while on the job. Mr. Dyon of the Western Electric Company regards this book very highly, and several industrial engineers have been heard to express their appreciation of it as a source book of research to which they have only indirect means of contact. It would be interesting to know how many recall who first used the phrase "The Worker-in-His-Work" which entitles the review. College personnel activities are coming to the front and a review of three of these books by Mr. Distler, Director of Student Personnel at New York University, University Heights Section, is included here. In the last review by I. S. Noall of the State Department of Instruction in Utah, there is collected together as "Tools of the Vocational Office" much useful occupational information. Under "Briefer Mention" are factual reviews of books in related fields, such as vocational information, economics, psychology, sociology; and under "New Books" are listed all recent books of immediate and related interest to workers in the Personnel Field. In this issue are included new books published during the months of February and March. "Personnel Books" went to press on April 1, 1930.

TO UNDERSTAND "THE WORKER-IN-HIS-WORK"

PSYCHOLOGY AND INDUSTRIAL EFFICIENCY.
By H. E. Burtt. New York: Appleton,
1929, 390 pp.

Reviewed by A. H. Dyon, *Western Electric Company*

In his most recent book, Dr. Burtt has furnished a companion volume to his PRINCIPLES OF EMPLOYMENT PSYCHOLOGY, which appeared in 1926. Interest in the development of selective tests and of scientific employment procedures in general has not slackened; if anything it has considerably increased. During the past few years, however, there has also been a growing recognition of the need for scientific study of the factors which affect the employee's efficiency after he has been hired. It is this phase of the man-power problem with which PSYCHOLOGY AND INDUSTRIAL EFFICIENCY is concerned.

Studies of industrial education, methods of work, fatigue, monotony, the working environment, morale, accidents, and effi-

ciency in executive work comprise the subject matter of the book. In dealing with these topics over-technicality has been avoided for the sake of a clear presentation to the student or business executive not interested in the statistical refinements which such studies involve. On the other hand, the author has stressed the importance of thorough-going, scientific methods if the results of industrial research are expected to be of any value.

In a comprehensive chapter on education the fundamentals of learning as demonstrated in the laboratory are applied to the industrial situation. By definite examples it is shown how these principles may be used to advantage in the instruction of the worker. For instance, results of experiments are given to show the general desirability of emphasizing accuracy rather than speed for the worker learning a new process. The author also describes several special devices to facilitate instruction. The stereoscopic principle to give the third dimension, or perception of depth, in showing industrial films and apparatus to provide an accurate record of a worker's progress in learning certain filing operations are illustrative. A new scheme of apprentice training is outlined as a substitute for less efficient methods which have been frequently employed. Sections on the training of foremen and salesmen are also included in this chapter.

Ways of determining the most effective methods of work are presented by reference to a number of specific cases. While the Gilbreth bricklayer classic is included, and effectively so, other less well known types of study will be found of equal interest. One of these, for example, deals with the nature of the stimulus and type of concentration as affecting the speed of reaction. The value of rhythm, the worker's posture, the suitability of tools, and similar questions come in for detailed treatment.

The importance of the fatigue problem is too obvious to require stressing. While the discussion is necessarily compressed, the problem is clearly stated and sufficiently illustrated with details of laboratory and industrial experiments. It is pointed out that the measurement of fatigue still depends very largely upon production and accident records. Many instances are cited to suggest the possible gains accruing from even the partial elimination of fatigue. Quite needless fatigue, arising out of such obvious factors as noise, faulty illumination, inefficient tool equipment, etc., may be readily eliminated as a matter of technical adjustments. Shortened hours and rest pauses, especially the latter, are shown to have a marked effect in the reduction of fatigue.

Much less is known about the problem of monotony. Boredom is a subtle thing. One person is happy with a repetitive task; another is bored with work of a varied and complex nature. Dr. Burtt's phrasing is more picturesque: "What is beefsteak for one individual may be potassium cyanide for another." A few laboratory studies are described and suggestions offered for the alleviation of monotony, but progress in this field has scarcely begun.

The discussion of working environment centers on the factors of illumination and ventilation. The following serves to illustrate the importance of proper illumination: "The National Safety Council mentions 91,000 accidents of which 24 per cent were wholly or in part due to poor lighting. Some of the manufacturers have reduced accidents 50 to 75 per cent by better illumination. At a rough estimate four and one-half billion dollars are lost annually in the United States through lowered production or accidents caused by poor light." By way of contrast, the New York post office, through improvements in illumination, effected operating economies amounting to $109,000 per year. The relation of visual adaptation to accidents, the influence of light distribution and similar questions are given careful analysis.

Ventilation—with temperature and humidity the important factors—is considered with reference to mental efficiency, industrial production and accidents, seasonal fluctuation, and the like.

In the discussion of other topics, frequent mention is necessarily made of accidents. The author therefore requires only

a brief chapter for summarizing the psychological aspects of this problem.

Of recent years, increasing attention has been given by industry to considerations of worker satisfaction and morale. The indications of and the reasons for this trend are too well known to require comment. The whole subject, closely related to the other factors of industrial efficiency, is given detailed treatment. To a review of familiar but very significant material is added mention of the newer possibilities of the psychiatric approach, at present a wide open field for experiment. In attacking one of industry's most important personnel problems, no contribution should be overlooked.

Before concluding, the author adds a chapter to discuss the relation of attention, memory, habit formation, and interest to efficiency in executive work.

Writing with obvious scientific restraint, Dr. Burtt has carefully avoided overstatement of results or extravagant claims for the value of the methods under discussion. There is little room to dispute that he has accomplished his purpose to provide not only an adequate text for college instruction but also an analysis which will be helpful to the business reader. For industry, its value lies in defining the problems of industrial efficiency, in reporting accomplishments to date, and in suggesting directions in which further effort may be profitably spent.

This review would be incomplete without a closing reference to a most important item, namely, the attitude of employees toward all experimental work in this field. There at times has been considerable misunderstanding, even hostility, to such research. Workers have been cold to efforts designed, in their thinking, to "speed them up." The best results can of course be obtained only with the active coöperation of all concerned. To this end, the worker and those interested in his welfare should have no misunderstanding of the position of industrial psychology. Dr. Burtt has been careful to emphasize the point, and states it effectively when he says: "There is nothing in the psychologist's bag of tricks designed to drive the worker or induce him to exert an unfair degree of effort. It is rather a question of finding better ways for him to work so that with the same effort he may accomplish more. In many cases it is a matter of merely removing some obstruction to his efficiency. . . . Misdirected activity is a loss both to the company and to the worker. . . . We are not proposing to promote efficiency at the expense of happiness, but to produce operatives who are happier because they are more efficient."

OBJECTIFYING EMPLOYMENT PROBLEMS

THE PRESTIGE VALUE OF PUBLIC EMPLOYMENT. By Leonard D. White and Thomas V. Smith. Chicago: University of Chicago Press, 1929, x + 183 pp., $2.50.

HELP-WANTED ADVERTISING AS AN INDICATOR OF THE DEMAND FOR LABOR. By Anne Bezanson. Philadelphia: University of Pennsylvania Press, 1929, xii + 104 pp., $2.00.

Reviewed by L. D. Hartson, *Oberlin College*

Dr. White's investigation, undertaken by the Community Research Committee of the University of Chicago, is a study of professional morale. The aim of the project was to compare the prestige value of employment by the city of Chicago with employment by private corporations. Opinions were obtained from 4,680 citizens of Chicago by interview and the use of printed schedules. The first sheet presented twenty paired occupations, one of which is in each case public, the other private. The second part of this schedule introduced a series of questions intended (1) to reveal general opinion about, and experience with, public officials and employees, and (2) to reveal opinions on some of the bases of judgment of public employment, such as courtesy, competence, publicity value, experience value, permanence, etc. Data were also obtained

from 690 other persons on a second schedule consisting of a word-association test, a rating scale and a completion test.

Prestige indices were computed which indicate that public employment is held in highest repute by the women, the young, the unskilled laborers, the foreign born and the lowest economic groups. Nearly five thousand representative citizens, taken collectively, expressed a substantial preference for private employment and rated city employees much lower than persons in similar occupations in the commercial world.

In Miss Bezanson's monograph, the Industrial Research Department of the University of Pennsylvania, has presented a detailed summary of the help-wanted advertising in the newspapers of Philadelphia from April, 1923 until August, 1929. Comparative data are reported from five other cities. Detailed consideration is given to six major industries: building construction, automobile manufacturing, metal manufacturing, hosiery and knit goods, and other textile industries, and to twenty-two specialized occupations. The object was to measure the changes in opportunities for employment in certain representative occupations, as indicated by the space devoted to advertising for persons to fill such positions, and to test the relative usefulness of the advertising index.

As an indication of the value of the help-wanted index to the personnel administrator, two of the more significant conclusions may be cited. (1) An intensive study of the metal manufacturing industry showed that the help-wanted index is a more sensitive indicator of changes in personnel than are the indices for the number of workers on the payroll, labor turnover, or accessions. (2) The classified help-wanted index is a good instrument for measuring the demand for different types of labor. This index is a very useful basis for planning for future needs both in placement and training. To the economist and vocational counselor the index indicates the direction of the currents of employment. For instance, for the last three years in the metal industry in Philadelphia, there has been a pressing demand for skilled workers: machinists, tool-makers, draftsmen, electricians, welders, etc., whereas the demand for unskilled laborers has been negligible.

Both studies are interesting illustrations of the adaptation of objective methods to the social science field. The Philadelphia study reports an evaluation of a hitherto unutilized source of data which promises to be of much value to personnel workers. The Chicago investigation illustrates a successful adaptation of objective tests for the purpose of registering personal opinion.

INDUSTRY SOCIALLY CONSCIOUS

SOCIAL ASPECTS OF INDUSTRY. By S. Howard Patterson. New York: McGraw-Hill, 1929, 539 pp.

Reviewed by Myer Bloomfield, *New York City*

It is in the sub-title "A Survey of Labor Problems and Causes of Industrial Unrest" that Dr. Patterson of the Wharton School best indicates the particular subject matter of this substantial volume. While presumably written for the teacher and the classroom, a service much needed at the present time when we consider what it means to choose text material from a library-full abundance of specialized labor and industrial literature, this book is about as useful an all-round introduction to industry's social problems as the busy man of affairs, who values straight thinking, is likely to find. It is an unusually easy book to read and to refer to, especially the latter.

Problems are best understood in terms of their background. So this survey starts with the pre-problem stages of modern industrial development. The matter is familiar enough, but always worth recalling; and, as given here, compactly, logically, and with touches of interpretation and interrelating with present situations, the ma-

terial takes on fresh significance. Problems of income and the wage-earner's standard of living are central problems of any industrial civilization. When these are partially met, social thinking, enlightened industrial administration, and legislation become free to deal with questions other than the marginal. The middle portions of Dr. Patterson's survey, therefore, deal with national prosperity, wage developments, industrial legislation, and the processes of organized labor relations. How tentative and experimental all such processes have had to be in a world not yet ready for the engineering approach to employment relationships, the author's simple outline of the facts makes crystal-clear.

Economic necessity is the great reformer and transformer. Disputes may rage and polemics crowd the ether but when sound business development calls for new policies and adjustments, when the necessity for success or solvency calls for better understandings, then there is a ready scrapping both of obsolete viewpoints and of machinery.

At least this readiness has marked the growth of some of our great industrial establishments under the leadership of men of understanding and coöperating gifts. And fittingly, Dr. Patterson concludes his survey with praises of employer contributions to the modernizing of industry. Problems of reconstruction remain. Never has industry therefore been at a more interesting stage. In the closing chapter a sense of this challenging future is brought home to the reader.

Worthy of special mention are the summary, the brief list of collateral reading, the list of references, the questions for discussion, and topics for investigation which end each section of the book.

COLLEGE GUIDANCE EMPHASIZED

COUNSELING THE COLLEGE STUDENT. By Helen D. Bragdon. Cambridge: Harvard University Press, 1929, x + 162 pp., $2.50.

PROBLEMS OF STUDENT GUIDANCE. By Maurice S. Sheehy. Philadelphia: Dolphin Press, 1929, viii + 264 pp., $2.50.

EVERY COLLEGE STUDENT'S PROBLEMS. By Oscar Helmuth Werner. Silver, Burdett, 1929, xi + 370 + xxix pp., $3.00.

Reviewed by Theodore A. Distler, *New York University*

Personnel work needs active stimulation through research; it is particularly gratifying to list three new books in this field. The three volumes noted above lay primary emphasis on the guidance problems of college students. Miss Bragdon's book will prove interesting to those engaged in counseling women college students. The Reverend Sheehy's volume should be, for two reasons, of primary interest to all people doing guidance work on the college level: first, because it is an explanation of fundamentally sound guidance principals, and second, because it is a thorough-going analysis of the present status of guidance in the outstanding male Catholic colleges in America. Professor Werner's book might reasonably be called a "college student's guide book." It is directed more to the student than to the guidance worker but gives the guidance worker a fairly comprehensive survey of Professor Werner's idea of the besetting problems of college students.

This is a time when the college personnel movement needs factual research. A few interesting facts upon counseling problems in several of the girls' colleges in the East will be found in COUNSELING THE COLLEGE STUDENT, but the book is largely a collection of opinion and is quite unsuccessful in indicating the present scope, types, and possible solutions of counseling problems in women's colleges. In strange contrast to the text of the book is a list at the end of the book of clear-cut proposals and recommendations for the organization and functioning of personnel activities. There are

unsatisfactory chapters upon college background, the counsel interview, and administration of counseling activities. The book offers a fairly complete list of student problems, but neglects to mention most of those of emotional adjustment.

PROBLEMS OF STUDENT GUIDANCE or a "Study of Administrative Attitudes on Current Practices Prevalent in American Catholic Colleges" confines itself to thirty-seven Catholic Colleges, each of which designated a man to serve on a committee for a coöperative study. The Reverend Sheehy has with their help made an extremely valuable contribution to the college personnel movement.

The problems of student guidance in the Catholic Colleges are discussed in detail. The author, in writing of the freshman, pre-registration functions, guidance steps, discipline, plan of life, health and religion, brings to these subjects a profound understanding of human nature and of guidance at the college level. The text abounds in thought-provoking bits. In speaking of individual record forms the Reverend Sheehy says, "The philosophy of education that dominates a school will be evident in the records kept of its students." Later when speaking of the interview he points out that "the student's problem must remain in the student's problem." It is as refreshing as a walk on a clear, cold day to wander through the soundly interesting pages of the Reverend Sheehy's book. In spite of the fact that it deals only with the problems of certain Catholic Colleges, the majority of the principles and practices emphasized make its reading worth while for all people seriously interested in personnel work.

EVERY COLLEGE STUDENT'S PROBLEMS is a handbook on college problems and college life, which is written for the undergraduate. Beginning with an inspirational message to college men, it treats in its various chapters of those problems which are likely to trouble students, and in each case suggests means of solving such problems. The following are a sample of what is covered: budgeting of time, money, and effort; study methods, personality, health, use of the library; note taking; behavior; thinking, etc. It is an excellent book for advisers to recommend to both college students and those who contemplate entering college. But the book is not without its weak points. Some of the "facts" are questionable which are brought to bear on the problem of "Does a College Education Pay." Then the important subject of extracurricular activities is almost entirely neglected in the discussion.

TOOLS OF THE VOCATIONAL OFFICE

1. ELEMENTS OF JOURNALISM. By Mary J. J. Wrinn. New York: Harper, 1929, xviii + 300 pp., $1.80.
2. BOOKS: FROM THE M.S. TO THE BOOKSELLER. By John L. Young. New York: Isaac Pitman, 1929, x + 121 pp., $1.00.
3. SIGNIFICANT POST-WAR CHANGES IN THE FULL-FASHIONED HOSIERY INDUSTRY. By George William Taylor. Philadelphia: University of Pennsylvania Press, Research Studies IV, 1929, xl + 130 pp., $2.00.
4. LABOR AND SILK. By Grace Hutchins. New York: International Publishers, 1929, 192 pp, $1.00.
5. LABOR AND AUTOMOBILES. By Robert W. Dunn. New York: International Publishers, 1929, 224 pp., $1.00.
6. TRENDS IN FOUNDRY PRODUCTION. By Anne Bezanson and Robert Gray. Philadelphia: University of Pennsylvania Press, Research Studies No. III, 1929, xvi + 77 pp., $1.50.
7. ELECTRICAL MACHINERY AND INDUSTRIAL ENGINEERING. By Alfred F. Dressler. New York: Electrical Trade School, Reference No. 2, 1929, 77 pp.
8. TOMORROW'S ADVERTISERS AND THEIR ADVERTISING AGENCIES. By George Harrison Phelps. New York: Harper, 1929, x + 256 pp.
9. AN EXAMINATION OF EARNINGS IN CERTAIN STANDARD MACHINE TOOL OCCUPATIONS IN PHILADELPHIA. By H. Larue Frain. Philadelphia: University of Pennsylvania Press, 1929, xiv + 85 pp., $1.50.

Reviewed by I. S. Noall, *Department of Instruction, Utah*

Vocational information is an essential tool in the vocational office. Presented in interesting form it is used to stimulate the child to early thinking upon his vocational problems. The guidance bureau which does not collect vocational information and make it accessible to boys and girls is neglecting a major function of its work.

Vocational information can be secured from various sources. The best source is the job analysis. But there are other means of collecting vocational information when such studies of the occupations have not been made. There is being published today a large number of books offering facts about the vocations. Most of them are not written from the vocational guidance viewpoint. But they include statistical facts about production, wages, distribution of labor, and above all, changing vocational conditions. Such facts are a part of the material needed by the boy or girl in making his choices of a vocation.

A number of these books are reviewed below. They are referred to by number in the bibliography above.

1. The study of journalism proposes a plan for training high school students in the principles and art of this occupation. Brief explanation and discussion of principles are amply illustrated by samples culled from best newspaper practice as patterns for students to model after. While journalism is usually considered to be a college subject, the feasibility of the plan as a high school undertaking is vouchsafed by its successful application by the author in the George Washington High School of New York City. It should be an invaluable asset to schools maintaining weekly or monthly publications. When so used, its value as a system of guidance, through participation, is of the finest quality.

2. The semi-technical volume upon the manufacture of books warrants its place in Pitman's Common Commodities and industries Series. It presents the pertinent facts every author and other well informed person should know about the publication of a book, including the selection of a publisher, the sale of the M. S., the type, composition, illustration, make-up of the book and its ultimate marketing. It is an excellent addition to the secondary school and public library literature on vocations and industries.

3. Increasing mechanization, greater production and the introduction of new styles are changes which have characterized the hosiery industry during the past ten years. The volume upon this subject is intended to show pertinent trends in the industry as a guide to manufacturers of machinery, managers of hosiery mills and labor organizations in the determination of practices and policies.

Trends indicated are: Marked increase in production of full fashioned silk hosiery, totaling 300 per cent increase between 1924 and 1929; increase in equipment to equal production demand by late 1926; near discontinuance in the use of cotton in full fashioned hosiery; reduction in output of seamless goods; marked per capita increase in consumption, recent over equipment, and installation of new machinery designed to manufacture only sheer stockings.

4. Labor and Silk is the first of a series of studies proposed by the Labor Research Association as a Labor and Industries Series. It is designed to present the workers' problems and outlook in certain basic industries. Representing an avowedly labor point of view, it emphasizes the grievances and hardships of the worker and the problems anticipated in organizing the industry for collective bargaining.

Miss Hutchings has traveled through the chief silk producing countries of the world and has spent five years in the gathering of data for this volume. The pitting of the southern mills against the northern, the speeding up of labor, the lowering of wages and unemployment are problems treated. While it is admitted that the rationalization of industry will undoubtedly continue, a part of the gains are claimed for the worker whose present lot is held to be untenable.

5. Labor and Automobiles is the second of the ten studies proposed by the Labor Research Association. It presents the story of the meteoric growth of the automobile industry and its unbelievable profits to the successful owners. In contrast, the

mechanization of the industry, the speeding up of work, and the subjugation of the worker are vividly described. The author claims that wide-spread advertising for help, even in the face of labor surplus in manufacturing centers, has created such an over supply of men that the wages and conditions of work are easily dictated by the employers, and are becoming most unsatisfactory to workers.

To date all efforts to organize the workers in the interest of securing better working conditions through collective bargaining have been futile and the American Federation of Labor considers the task impossible. A modern up-to-date factory workers' union is proposed that "will cover the whole industry as well as every operation in the plant," and include "all workers regardless of skill, nationality, color, sex, or age."

6. The study of Bezanson and Gray shows the trends of foundry production of gray iron and steel in and about Philadelphia during the years 1926 to 1929 inclusive. Output in small foundries closely parallels that of the larger plants. City foundries are gaining on the rural institutions and maintained 56 per cent capacity production in 1928 as against 33.8 per cent in outside plants. Causes of over capacity and over stock in relation to the volume of business are discussed, together with suggestions for balancing the seasons' demands. The information in this volume on the steel and foundry industry is of primary interest to those in the Philadelphia region.

7. The volume by Alfred F. Dressler is a brief hand book and reference designed as a guide in trade practice and as a laboratory manual in connection with courses on the installation and maintenance of electrical machinery offered at the New York Electrical School. Professor Dressler describes the chief characteristics and hookups of A. C. and D. C. motors, generators, transformers, storage batteries, etc. in Section I. In Section II under *Industrial Engineering* he treats the use of the slide rule, trigonometeric functions and logarithms in electrical measurements and calculations.

8. Here is a popular treatment upon advertising that at once tells advertisers how to make the most of their advertising and agencies what they must do to "deliver." While non-technical in treatment Mr. Phelps makes good in his effort to put over the message that the coming years will demand a service that is both an art and a profession.

9. Dr. Frain offers an interesting study of the variability wages and of factors contributing to the same. The data, taken as they are, from many plants and for closely related machine operations, contribute to the answer to the question, "Is there a 'market wage' in any locality or in any given occupation, assuming that the 'market' is normal and competitive?"

As indicated above, these publications are a sampling from the large volume of similar literature issuing from our press every year. None of them are presented for the specific function of vocational guidance. Two of them though strictly controversial in nature present an expression of the labor issue that will be of wide interest to persons in these industries and whose children are following in the parents' footsteps. They also indicate the controversy between labor and capital that is less pronounced but none the less present in much of our modern industry. Three of the volumes are trade or industry studies designed for employers' use in determining policies of management. However, the data presented show trends of wages, periods of employment and manufacturing changes. These are of interest to workers in the industries reported. They are also indicative of trends that occur and may be observed in other fields. ELEMENTS OF JOURNALISM and ELECTRICAL MACHINERY will find direct use as school texts. The former will exert an influence in guidance; the latter assumes that a vocational choice has been made. BOOKS is a handbook as well as a source of popular information. Every boy and girl in the secondary schools should read it. TOMORROW'S ADVERTISERS is a prophecy of the future. As such, it will be a guide and a stimulus to those in the business. It will also strike fire with the young hopeful who has talent and who is now groping to find his place in the sun.

Briefer Mention

Occupations for College Women. A Bibliography. By Chase Going Woodhouse and Ruth Frances Yeomans. Greensboro, N. C.: Bul. No. 1 of the North Carolina College for Women, 1929, 290 pp.

A bibliography of 1801 references to books and articles, published from 1920 to 1928 inclusive, for the vocational guidance of college women. Each reference is annotated, to indicate the kind of information. Where available, Library of Congress and Dewey Decimal classification numbers are cited. The classification of material is suggested by the following topics: The Arts, Manufacturing, Education, Engineering, Banking, Health, Legal Fields, Museum Work, Married Women's Work, Vocational Tests, List of Professional Periodicals. It is planned by the Institute of Women's Professional Relations, by whom this bibliography is issued, to publish a yearly supplement.

Fixation of Wages in Australia. By George Anderson. Melbourne: Macmillan, 1929, 568 pp, $8.50.

The system of compulsory arbitration of labor disputes has been in effect in part or all of Australia since 1895, yet strikes are not unknown, and the decisions of the Arbitration courts have been frequently defied. One source of difficulty has been conflict between Commonwealth and State jurisdiction; another in the jurisdictional disputes between labor unions, and still another in the administration of the laws. The first half of this book describes the various tribunals which have been set up for the fixing of wages, and the second half presents the decisions which they have made. By classifying the cases according to the subject at issue, the author presents the principles which have been established for the fixation of wages.

Economics and Ethics: A Study in Social Values. By John A. Hobson. New York: Heath, 1929, xxxi plus 489 pp.

This book is an attempt to redefine economic concepts in terms of human welfare. The difficulty in securing a generally acceptable definition of welfare is recognized, and solved by the substitution of a "hierarchy of values" which admits many forms of welfare. Ethics is the science and the art of valuation.

Emphasis upon other values than material ones will force, and is forcing, economic theory to enlarge its scope. Instead of mere description of things as they are, it must consider the problem of how the economic system may be made to serve the interests of human welfare. The author is particularly interested in the application of these principles to standards of living, international relations and incentives to labor.

A Study of Introvert-Extravert Responses to Certain Test Situations. By R. A. Schwegler. Columbia University Contributions to Education, No. 361, 1929, 183 pp.

A battery of 12 tests was administered to 103 introverts and 103 extraverts who were selected by the Martson scale. The introvert is found to be slower in verbal response, less productive of words, ideas, and movements, slightly more tenacious in holding to the evidence of own experience, and more aware of morbid anxieties and psychopathic thinking. In the free association test, short reaction time and superficial responses characterized the extravert, while longer reaction time and profounder responses characterized the introvert. Introverts appeared much less willing to 'take a chance' in mental tests than did extraverts. The introverts were definitely slower in manual movements, particularly when under pressure, and the emotional life of the extravert was admitted to be much freer and more vivid. Intelligence and age were not factors in these differences. There is an excellent bibliography.

The Psychology of Adolescence. By Fowler D. Brooks. Boston: Houghton, Mifflin, 1929, 630 pp.

This volume, which is apparently in-

tended as a college textbook in secondary education, brings together a large amount of scientific literature. The first six chapters (175 pages) are devoted to the field of physical and physiological development, and the measurements which have been obtained in these fields over a long period of time. From this point on, the treatment is from the viewpoint of the author's own beliefs, and the methods of older educational writers are used in the discussion of the problems of adolescence.

Scientific Method. Its Function in Research and in Education. By Truman L. Kelley. Columbus: Ohio State University Press, 1929, 195 pp.

Five lectures upon the method of research, the rôle of human opinion in science, psychological units of measurements, the bearing of scientific development upon life, and the mental traits of men of science, are included in this volume. In an analysis of the mental traits of men of science, Kelley is led to conclude that there are no exceptions to the following: (a) The great man of science is industrious. (b) He questions authority in his field of achievement. (c) He is apt at drawing inferences. (d) His sense of logic is sound. (e) He is a keen observer. (f) He is dependent on observed facts. (g) He is inventive in the matter of techniques. (h) He is rich in number of hypotheses. (i) His hypotheses are amenable to observational tests.

Our Economic Life: A General Social Science. By Thomas Nixon Carver and Gladys Marion Adams. Philadelphia: Winston, 1929, x plus 373 pp.

This book is an introduction to the social sciences, designed for high school students. It starts with a brief account of the Industrial Revolution. The body of the book is devoted to a simple exposition of present-day economic organization and the final chapters introduce the student to some of the more obvious social problems, such as those of the "social misfit" and the immigrant. Social coöperation is stressed as the general method of solution for these problems. A unique feature of the book is in its illustrations, which are almost entirely cartoons. Academic terminology is avoided, and such technical terms as are used are defined in a glossary at the end of the book.

The Oldest Profession in the World. Its Underlying Causes, Its Treatment and Its Future. By William J. Robinson. New York: Eugenics Publishing Company, 1929, 100 pp., sold by subscription only.

The well-known author of many guidance books upon sex problems writes a factual statement of present conditions in the profession of prostitution and its place in the lives of people. The fundamental cause of prostitution is given as "the existence of the sex instinct and the imperative need of its satisfaction." Prostitutes are found to be morally, mentally, and physically as normal as the average woman in other walks of life. The thesis is advanced that prostitution should have the same legal and social status as other occupations.

New Books

LABOR RELATIONS

CARROLL, M. R. *Unemployment Insurance in Germany.* Washington: Bookings Inst., 1930.

CHILDS, H. L. *Labor and Capital in National Politics.* Columbus: Ohio State Univ. Press, 1930, 286 pp., $3.00.

GIBBERD, KATHLEEN. *Workmen's Fare.* London: B. C. M., 1930, 128 pp., 3s. 6d. Net.

Industrial Group Insurance. New York: Nat. Ind. Conf. Bd., 1929, 46 pp., 75¢.

ROTHSTEIN, THEODORE. *From Chartism to Laborism.* New York: Int. Pub., 371 pp., $2.50.

Unions Provide Against Unemployment. Washington: Am. Fed. of Lab. 1929, 109 pp., 75¢.

OCCUPATIONAL ANALYSIS

Illumination Research Committee. Technical Papers. London: H. M. S. O., 1930, 2s. 6d. Net.

STURTEVANT, S. M., AND STRANGE, R. M.

A Personal Study of Deans of Girls in High Schools. New York: T. C., Columbia University, 1929, 157 pp., $1.50.

MENTAL TESTS AND USES

McAdory, Margaret. *The Construction and Validation of an Art Test.* New York: T. C., Columbia University, 1929 35 pp., $1.50.

MacLaren, J. P. *Medical Insurance Examination.* New York: Wm. Wood, 1930, 688 pp., $10.00.

Newcomb, T. M. *The Consistency of Certain Extrovert-Introvert Behavior Patterns in 51 Problem Boys.* New York: T. C. Columbia University, 1929, 123 pp., $1.50.

Olson, W. C. *The Measurement of Nervous Habits in Normal Children.* Minnesota: Univ. of Minn. Press, 1929, 109 pp., $2.00.

Russell, Charles. *Standard Tests.* Boston: Ginn, 1930, 521 pp., $2.00.

GUIDANCE (VOCATIONAL AND EDUCATIONAL)

Burns, C. *An Introduction to the Social Sciences.* London: Allen & U, 1930, 112 pp., 3s. 6d. Net.

Pear, T. H. *The Art of Study.* London: K. Paul, 1930, 118 pp., 3s. 6d. Net.

Spicer, W. C. *Going to College.* Boston: Stratford, 1930, 34 pp., $1.00.

MENTAL HEALTH

Adler, Alfred. *Problems of Neurosis.* New York: Cosmopolitan, 249 pp., $3.00.

Bianchi, Leonardo. *Foundations of Mental Health.* New York: Appleton. 292 pp., $2.50.

Burr, B. *Practical Psychology and Psychiatry.* Philadelphia: Davis, 1930, 378 pp., $2.75.

Dearden, Harold. *The Science of Happiness.* London: Heinemann, 1930, 316 pp. 5s. Net.

MANAGEMENT AND ADMINISTRATION

Derby, W. O. *Store Management for Profit.* New York: Harper, 1929, 208 pp., $3.00.

Ford, Henry. *My Philosophy of Industry.* Harrap, 1930, 90 pp., 2s. Net.

Hubbard, Elbert. *Advertising and Advertisements.* Aurora; Roycrofters, 1929, 276 pp., $15,00.

Rautenstrauch, Walter. *The Successful Control of Profits.* New York: Forbes, 1930, 255 pp., $3.00.

Sherwood, J. F. and others. *Constructive Accounting.* Cincinnati: South-Western Pub. Co., 1929, 252 pp., $2.50.

Sherwood, J. F. and others. *Fundamentals of Accounting.* Cincinnati: South-Western Pub. Co., 1929, 221 pp., $2.50.

Taylor Society. *Scientific Management in Industry.* New York: Harper, 1929, 498 pp., $6.00.

Tournier, E. J. *Materials Handling Equipment.* New York: McGraw-Hill, 1929, 371 pp., $4.00.

Walker, L. C. *The Office and Tomorrow's Business.* New York: Century, 1930, 198 pp., $1.50.

INDUSTRIAL EDUCATION

Ahmad, Z. U. *Systems of Education: England, Germany, France and India.* London: Longmans, 1930, 8s. 8d. Net.

Harrington, H. L. *Program Making for Junior High Schools.* New York: Macmillan, 181 pp., $1.75.

Johnston, E. G. *Point Systems and Awards.* New York: Barnes, 175 pp., $1.00.

Naether, C. and Richardson, G. F. *A Course in English for Engineers.* Boston: Ginn, 1930, 344 pp., $2.60.

Prosser, C. A. and Bass, M. R. *Adult Education.* New York: Century, 1930, 408 pp., $2.75.

West, Michael. *Language in Education.* London: Longmans, 1930. 4s. 6d. Net.

VOCATIONAL INFORMATION

Altmaier, C. L. *Business Communication.* New York: Macmillan, 1930, 511 pp., $1.80.

Anon. *Bookbinding as a School Handicraft.* London: Arnold, 1930, 6d. Net.

Appel, J. H. *The Business Biography of John Wanamaker, Founder and Builder.* New York: Macmillan, 497 pp., $5.00.

Borden, R. C. and Busse, A. C. *The New Public Speaking.* New York: Harper, 164 pp., $1.50.

Brown, L. T. *Osteopathy.* New York: Am. Fd. for Blind, 1929, 50 pp., 50¢.

Farrow, Will. *Practical Cartooning for*

Profit. London: Hurst, 100 pp., 3s. 6d. Net.

GOLDING, HARRY. *The Wonder Book of Aircraft.* New York: Spon & Chamberlain, 1930, 256 pp., $3.00.

JOHNSON, V. E. *Electrical Recreation.* New York: Spon & Chamberlain, 1930, 160 pp., $1.00.

LEONARD, M. P. *History of Nursing and Sociology.* Bridgeport: Brewer-Colgan Co., 1929, 279 pp., $3.00.

MARRYAT, H. *Electrical Wiring and Contracting.* London: Pitman, 1930, 512 pp., 6s. Net.

OVERTON AND ROBERTSON. *Profitable Farm Management and Marketing.* Philadelphia: Lippincott, 1929, 392 pp., $2.00.

PUCKETT, H. W. *Germany's Women Go Forward.* New York: Columbia Univ. Press. 338 pp., $4.50.

RATCLIFFE, J. A. *The Physical Principles of Wireless.* New York: Dutton, 112 pp., $1.15.

ROBINSON, VICTOR. *Pathfinders in Medicine.* New York: Medical Life Press, 1929, 827 pp., $10.00.

SUPER, PAUL. *Formative Ideas in the Y. M. C. A.* New York: Asso. Press, 1929, 226 pp., $3.00.

TAUT, BRUNO. *Modern Architecture.* New York: Boni. 222 pp. $12.00.

TILNEY, F. C. *The Principles of Photographic Pictorialism.* Boston: American Photo. Pub. Co., 1930, 227 pp., $5.00.

WELLINGTON, AMY. *Women Have Told.* Boston: Little, Brown, 204 pp., $2.50.

WHATHAM, RICHARD. *Meterology for Aviator and Layman.* New York: Stokes, 195 pp., $3.00.

PSYCHOLOGY

ADLER, ALFRED AND OTHERS. *Guiding the Child; On the Principles of Individual Psychology.* New York: Greenberg, 1930, 268 pp., $3.00.

ADLER, ALFRED. *The Pattern of Life.* New York: Cosmopolitan. 273 pp., $3.00.

ALLEN, A. H. *Pleasure and Instinct.* New York: Harcourt, 1930, 345 pp., $4.00.

GESELL, A. L. *Learning and Growth in Identical Infant Twins.* Worcester: Clark Univ. Press, 1929, 124 pp., $2.00.

HERRIOTT, M. E. *Attitudes as Factors of Scholastic Success.* Urbana: Univ. of Ill. 1929, 72 pp., 50¢.

LAIRD, D. A. AND MULLER C. G. *Sleep.* New York: John Day, 1930, 224 pp., $2.50.

LASHLEY, K. S. *Brain Mechanisms and Intelligence.* Chicago: Univ. of Chicago Press, 1929.

MENNINGER, K. A. *The Human Mind.* New York: Knopf, 472 pp., $5.00.

MONROE, W. S., AND OTHERS. *Educational Psychology.* New York: Doubleday, Doran, 1930, 620 pp., $2.50.

THOULESS, R. H. *The Control of the Mind.* London: Hodder, 1930, 212 pp., 2s. 6d.

VILLEY, PIERRE. *The World of the Blind.* London: Duckworth, 1930, 494 pp., 7s. 6d.

WEST, P. V., AND SKINNER, C. E. *Psychology for Religious and Social Workers.* New York: Century, 1930, 541 pp., $3.00.

ECONOMICS

BENT, SILAS. *Machine Made Man.* New York: Farrar & Rinehart, 1930, 358 pp., $3.00.

CROWTHER, SAMUEL. *Prohibition and Prosperity.* New York: John Day, 1930, 87 pp., $1.00.

DORAN, H. B. *Materials for the Study of Public Utility Economics.* New York: Macmillan, 802 pp., $5.00.

FOREMAN, C. J. *Efficiency and Scarcity Profits.* Chicogo. Univ. of Chicago Press, 1930, 354 pp., $4.00.

KEEZER, D. M. AND MAY, STACY. *The Public Control of Business.* New York: Harper, 278 pp., $3.00.

KEISTER, A. S. *Our Financial System.* New York: Macmillan, 508 pp., $2.40.

KNIGHT, B. W. AND SMITH, N. L. *Economics.* New York: Ronald, 1930, 549 pp., $4.00.

MAGEE, M. A. *Trends in Location of the Women's Clothing Industry.* Chicago: Univ. of Chicago Press, 1930, 199 pp., $2.00.

NYSTROM, P. H. *Economics of Retailing.* New York: Ronald, 1930, 468 pp., $10.00.

NYSTROM, P. H. *Economic Principles of Consumption.* New York: Ronald, 1929, 597 pp., $5.00.

PIGOU, A. C. *The Functions of Economic Analysis.* New York: Oxford, 1929, 22 pp., 35¢.

SPANN, OTHMAR. *The History of Economics.* New York: Norton, 1930. 328 pp., $3.50.

SOCIOLOGY

DAVIES, S. P. *Social Control of the Mentally Defective.* New York: Crowell, 1930, 408 pp., $3.00.

HEARNSHAW, F. J. C. *Social and Political Ideas of Some Great French Thinkers of the Age of Reason.* London: Harrap, 1930, 252 pp., 7s. 6d. Net.

PEIXOTTO, J. B. *How Workers Spend a Living Wage.* Berkeley: Univ. of Cal. Press, 1929, 90 pp., $1.25.

SELIGMAN, E. R. A. AND JOHNSON, ALVIN. *Encyclopaedia of the Social Sciences.* New York: Macmillan, 673 pp., $7.50.

PHILOSOPHY

SCHWEITZER, ALBERT. *The Philosophy of Civilization.* New York: Macmillan, 1929, 312 pp., $4.25.

Current Periodicals

PREPARED BY LINDA H. MORLEY, *Industrial Relations Counselors, Inc.*

AGE

PERSONNEL CLUB OF NEW YORK. Older and married women in industry. *News Letter,* January 2, 1930, Vol. 6, p. 3–6.

Jobs; References; Projects and studies. Discussions at a meeting of the Club.

Problem of middle age in industry. *Monthly Labor Review,* March, 1930, Vol. 30, p. 541–544.

Summary of papers read at employment security conference of the American Management Association.

BATÁ WORKS

DEVINAT, PAUL. Working conditions in a rationalised undertaking; the Batá system and its social consequences. *International Labor Review,* January, 1930, Vol. 21, p. 45–69, February, 1930, Vol. 21, p. 163–186.

Considerable detail of plans and policies, Result of a three weeks study on the spot.

GAVIT, JOHN PALMER (Associate Editor, Survey, in charge of Foreign Service). Batá; the shoemaker who stitched mass production onto the uppers of feudalism. *Survey,* March 1, 1930, Vol. 63, p. 623–626, 673–677.

With a yearly business of $35,000,000, this plant has introduced American mass production methods in Central Europe and a policy of selling direct to the consumer among a feudal community of 12,000 factory workers in a modern setting.

BONUS SYSTEM

POLAKOV, W. N. Task and bonus wage system helpful in power plants. *Power,* December 3, 1929, Vol. 70, p. 893–895. (Abstract in *Factory and Industrial Management,* March, 1930, Vol. 79, p. 577).

Practical discussion of objects and rewards of task in bonus wage system; bonus for power plant personnel; sample instruction card of task.

COÖPERATION

COWDRICK, EDWARD S. Some results of labor coöperation. *Society of Industrial Engineers Bulletin,* February, 1930, Vol. 12, p. 17–18.

Leadership of foremen emphasized. Employee representation advocated.

EDUCATION

JACKS, L. P. (Principal, Manchester College, Oxford). Is your business a school room? *Nation's Business,* February, 1930, Vol. 18, p. 50, 53, 218–20.

Plea for adult education, particularly along the lines of the industry in which the worker is engaged.

HOURS OF LABOR

Federal Council of Churches of Christ in America, Research and Education Department. Long hours in the steel industry. *Information Service,* February 15, 1930, Vol. 9, p. 1–4.

Study made last summer covering eight districts and five types of plants. In all 155 plants were covered. Wage rates are given in some cases.

INDUSTRIAL RELATIONS

LITTLE, DR. ARTHUR D. (President, Arthur D. Little, Inc.). Science and labor. *Stone and Webster Journal*, January, 1930, Vol. 46, p. 34–52.

Includes a great many examples of mechanization of industrial activities showing favorable results for the worker.

LABOR

WOLMAN, LEO. American labor since 1920. *Journal of the American Statistical Association, Supplement*, March, 1930, Vol. 25, p. 158–163.

Wages and hours in a number of industries compared.

LABOR DECISIONS

WITTE, E. E. Labor's resort to injunctions. *Yale Law Journal*, January, 1930, Vol. 39, p. 374–387.

Includes a list of 73 injunction actions by or on behalf of labor against employers or public officials.

LABOR PRODUCTIVITY

Productivity of labor in 11 manufacturing industries. *Monthly Labor Review*, March, 1930, Vol. 30, p. 501–517.

Covers 1926 and 1927. Industries included are: Iron and steel; Boots and shoes; Leather tanning; Slaughtering and meat packing; Petroleum refining; Paper and pulp; Cement manufacturing; Automobiles; Rubber tires; Flour milling; Cane-sugar refining.

MACHINERY IN INDUSTRY

BAKER, ELIZABETH F. Economic and social consequences of mechanization in agriculture and industry—discussion. *American Economic Review, Supplement*, March, 1930, Vol. 20, p. 177–180.

Results of a study of the displacement of workers by machinery in the printing business.

DENNISON, HENRY S. (Dennison Manufacturing Co.). Some economic and social accompaniments of the mechanization of industry. *American Economic Review, Supplement*, March, 1930, Vol. 20, p. 133–155.

Challenge by the president of a large manufacturing company to the rest of the business world to answer the questions he raises: What are we coming to? Is the mechanization of industry and the stricter regimentation of all the occupations of the business world to continue? And if it does, what will it mean to us as citizens and as workers? How will it affect the goods we use and the organized structure of business itself?

MAYO, ELTON (Harvard University). Human effect of mechanization. *American Economic Review, Supplement*, March, 1930, Vol. 20, p. 156–176.

Results of a study of fatigue made at Western Electric Company, Chicago works.

MANAGEMENT

LANDAUER, DR. EDMUND (Managing Director, Several Continental Textile Companies; Secretary, International Committee on International Management Congresses). Management from a distance. *Management Review*, March, 1930, Vol. 19, p. 75–84.

Details of a system of supervision used by a foreign administrator. Number and kind of reports required indicated.

MORTALITY STATISTICS

New low records for mortality in 1929. *Statistical Bulletin*, January, 1930. Vol. 11, p. 1–11.

Favorable aspects of the 1929 mortality record; Unfavorable aspects of the 1929 mortality record; Increased longevity of wage-earners, 1911 to 1928.

OCCUPATIONS

Retail Credit Company. Composition roofing. *Industry Report*, March, 1930, Vol. 5, p. 25–27.

Treats of asphalt and asbestos roofing

and does not cover such products as wood shingles, tile and metal roofing of various types. Safety and health hazards and an occupation classification are given.

Retail Credit Company. Small arms amunition. *Industry Report*, January, 1930, Vol. 5, p. 1–12.

Details of hazards, processes and occupations in the manufacture of cartridges and shells for rifles and shotguns.

Retail Credit Company. Sugar. *Industry Report*, February, 1930, Vol. 4, p. 13–24.

Details of process of manufacture and classification of jobs, as well as potential health hazards are described.

PENSIONS

SEAGER, HENRY R. (Columbia University). Need of provision for the aged in New York. *American Labor Legislation Review*, March, 1930, Vol. 20, p. 68–72.

Extracts from a statement submitted to the New York Commission on Old Age Security at its hearing in New York City, December 4, 1929.

PHYSICAL EXAMINATIONS

DAVIS, WILLIAM LYNN (Industrial Engineer, A. F. Staley Manufacturing Co.). Value of physical examinations. *Society of Industrial Engineers Bulletin*. February, 1930, Vol. 12, p. 7–13, 18.

Points out the difficulties encountered in workmen's compensation cases when physical examinations are not given. Cites a number of examples.

PSYCHOLOGY

DEWEY, JOHN (Columbia University). Psychology and work. PERSONNEL JOURNAL, February, 1930, Vol. 8, p. 337–341.

Philosophical discussion of modern psychological aspect of work. Speech at annual meeting of Personnel Research Federation.

RESEARCH

GRAS, N. S. B. Value of research to business. *Bulletin of the Business Historical Society*, November, 1929, Vol. 3, p. 3–6.

Proposal to use the history of the Dennison Manufacturing Company (recently completed by the author of this article) as a standard by which to check the condition of other companies.

SAFETY

JACOBSOHN, WILLIAM, M.D. (Department of Health, N. Y. C.). Health and safety survey of 25 leading department stores in New York. *American Journal of Public Health*, March, 1930, Vol. 20, p. 277–286.

Study also covers other industrial relations activities such as benefits, vacations, etc. Store names are not mentioned.

National Bureau of Casualty and Surety Underwriters—Library. Official State regulations, orders, advisory pamphlets, and labor laws relating to safety. *Monthly Labor Review*, February, 1930, Vol. 30, p. 481–494.

Arranged by state. Give contents of pamphlet when more than one subject is covered.

National Safety Council. State safety requirements in industry. *National Safety News*, March, 1930, Vol. 21, p. 19–26.

One of a series of Safe Practices Pamphlets. There is included a list of publications issued by the states, giving their standards and a subject chart indexing the publications.

SALARIES

GOODRICH, ERNEST P. (M. Am. Soc. C. E.). Philosophy of engineers' salaries. *American Society of Civil Engineers' Proceedings*, 1930 p. 409–426.

Results of a study of the basic factors which should be given consideration in determining engineers' salaries. Includes statistical data on cost of living, salaries actually paid, age distribution, etc.

SCIENTIFIC MANAGEMENT

GILBRETH, LILLIAN M. (President, Gilbert, Inc.; Vice-President, American Management Association). Management movement in Japan. *Management Review*, February, 1930, Vol. 19, p. 39–44.

Impressions of a delegate of the American Management Association to the World Engineering Congress in Tokyo.

STABILIZATION OF EMPLOYMENT

MAHER, AMY G. Effect of concentration of industry on seasonal variation of employment. *Journal of the American Statistical Association*, March, 1930, Vol. 25, p. 41–47.

Study of eight cities in Ohio.

WOLMAN, LEO (New York School for Social Research; Research Department—Amalgamated Clothing Workers of America). Bearing of industrial equilibrium on regularity of operations and of employment. *Bulletin of the Taylor Society*, February, 1930, Vol. 15, p. 6–17, 54.

Discussed by: Stuart Chase; James T. Madden; Leonard Kuvin; Henry P. Kendall; C. B. Hammond; Hudson B. Hastings; Norman Lombard.

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